2004 Data Summary
Missouri Nutrition Surveillance System

Pregnancy Nutrition Surveillance

Missouri Department of Health and Senior Services

PREFACE

This document summarizes selected key maternal health indicators of women, participating in the Missouri WIC Program in 2004, which contributed to the Missouri Pregnancy Surveillance System in 2004.

Missouri Department of Health and Senior Services

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EXECUTIVE SUMMARY

Maternal health risk factors that affect the mother and her birth outcome include maternal prepregnancy weight, weight gain during pregnancy, and anemia status. Behavioral factors such as tobacco use and time of enrollment in prenatal care can influence birth outcome and the mother's health as well.

The Centers for Disease Control and Prevention (CDC) Pregnancy Nutrition Surveillance System (PNSS) has monitored health and behavioral risk factors among low-income, pregnant, prenatal, and postpartum women, enrolled in federally funded public health programs in participating states since 1979. The Missouri 2004 PNSS only used data from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The data included complete information on prenatal and postpartum records with demographics, health and behavior risk factors, and infant birth outcomes.

In 2004, the largest proportion of PNSS population in Missouri was White, Non Hispanic women. The Hispanic portion of the population has been increasing from 1995 to 2004. Women age 20-29 years made up the largest proportion of Missouri PNSS population in 2004. The prevalence of young mothers (17 years and younger) has been decreasing over the last 10 years. Most of the Missouri PNSS participants in 2004 had high school or higher education. Two thirds of PNSS participants were at income level 0-100% of the federal poverty level. Almost all of the participants reported not being migrants.

Prepregnacy weight status is a determinant of weight gain during pregnancy and birthweight. A large proportion of Missouri 2004 PNSS participants reported being overweight and obese during the prepregnancy period. Black, Non Hispanic women and women in the 30-39 years of age group were at higher risk. In contrast, Asian/Pacific Islander women, as well as women less than 15 years old, were most likely to be underweight before the pregnancy.

Adequate maternal weight gain, based on prepregnancy weight status, is considered to be a major determinant of birthweight as well as infant morbidity and mortality. Even with improved access to nutritious foods and nutrition education, the majority of women participating in 2004 Missouri PNSS and National PNSS showed inadequate (greater than ideal or less than ideal) gestational weight gain. The Asian/Pacific Islander women were more likely to gain less than ideal weight, while White, Non Hispanic, American Indian/Alaskan Native, and Black, Non Hispanic women reported gaining greater than ideal weight during pregnancy. Approximately a third of Missouri PNSS participants in the 15-17, 18-19, and 20-29 age groups gained adequate gestational weight.

Pregnant women are at higher risk for iron deficiency anemia because of the increased iron requirements of pregnancy. The rate of anemia (low hemoglobin/hematocrit) in the third trimester of pregnancy and postpartum among PNSS participants in Missouri for the last 10 years has shown no improvement. Black, Non Hispanic women and 15 -19 years old participants were more likely to have low hemoglobin/hematocrit during the 3rd trimester of pregnancy and postpartum. White, Non Hispanic women had the smallest proportion of low hemoglobin/ hematocrit.

Pregnancy outcomes are better if prenatal care begins in the first trimester of pregnancy. From 1995-2004, the majority of women in Missouri PNSS received medical care during the first trimester of pregnancy. In 2004, a higher percentage of Missouri PNSS women were enrolled in WIC during the first trimester of pregnancy, than in the second and third trimesters and post partum.

Smoking during pregnancy is associated with an increased risk of several poor birth outcomes including low birthweight. From 1995-2004, more than one third of women smoked 3 months prior to pregnancy and about one fourth smoked in the last 3 months of pregnancy. Race/ethnicity and educational level had strong impacts on participant's smoking behavior. White, Non Hispanic participants had the highest rate of smoking, while Asian/Pacific Islander participants had the lowest rate for both smoking 3 months prior to and the last 3 months of pregnancy. The smoking rates of women who smoked 3 months prior to pregnancy and during the last 3 months of pregnancy were the highest among participants with less than 12 years of education.

In the Missouri 2004 PNSS population, women who were underweight before pregnancy and those who gained less than ideal gestational weight were more likely to deliver a low birthweight baby. Older women (40 years and older) and Black, Non Hispanic women had the highest percentage of low birthweight infants. Women who were overweight and obese before pregnancy, and women with greater than ideal maternal weight gain were more likely to have a high birthweight baby. Hispanic women and women aged 30- 40 years and over were at higher risk of having a high birthweight infant. The 10-year trend in high birthweight demonstrates a slight decline in the percentage of babies born overweight.

Risk factors for preterm delivery, according to Missouri 2004 PNSS data, include being underweight before pregnancy, gaining less than ideal weight during pregnancy, being in the age groups of younger than 15 years and 40 years and older. Black, Non Hispanic women were more likely to have a preterm baby, compared to all other racial and ethnic groups.

In Missouri PNSS 2004, the proportion of women who initiated breastfeeding increased by one percentage point from 2003. Over two thirds of Hispanic women, women with greater than high school education, and more than one half of the women age 30 to 40 years and over were more likely to initiate breastfeeding in 2004.

INTRODUCTION

The Pregnancy Nutrition Surveillance System (PNSS) is a program-based surveillance system that monitors maternal health and behavioral indicators associated with birth outcomes among low-income pregnant women participating in federally funded maternal and child health programs.

In 2004, Missouri PNSS used data from the Special Supplemental Nutrition Program for Women, Infants and Children (WIC). The number of records accepted for the Missouri PNSS in 2004 was 46,042, which is 2.6% higher than in 2003 (44,884). Records analyzed by the Centers for Disease Control and Prevention (CDC) consisted of 8.2% prenatal records, 20.7% postpartum records, and 71.1% of complete records. Data were contributed by 175 WIC clinics, which collected data on demographic, health, and behavioral indicators from women during prenatal and postpartum clinic visits.

Demographic data collected included maternal race/ethnicity, age, educational level, poverty level and migrant status. Data on participation in food and medical assistance programs (e.g., Food Stamp Program or Medicaid) was collected as well.

In PNSS, indicators on which data were collected include maternal health and behavioral indicators and infant health indicators. Maternal health indicators consisted of prepregnancy weight, gestational weight gain and anemia status. The behavioral indicators assessed were smoking, WIC enrollment, and start date of medical care. Infant health indicator data included birthweight, preterm births, full term low birthweight, and breastfeeding initiation.

The uniqueness of the 2004 data summary is that CDC provided states participating in PNSS with a summary of trends on some indicators. In addition, CDC generated combined 3-year tables for WIC clinics and counties that had less than 100 records available after exclusions. The combined 3-year tables contain 3-year average rates for maternal racial and ethnic distribution, age distribution, maternal health and behavioral indicators, and infant health indicators by clinic and county. Information from the combined 3-year tables was used to create maps showing rates on most important indicators (Appendices 1-12).

Limitations of the Pregnancy Nutrition Surveillance System

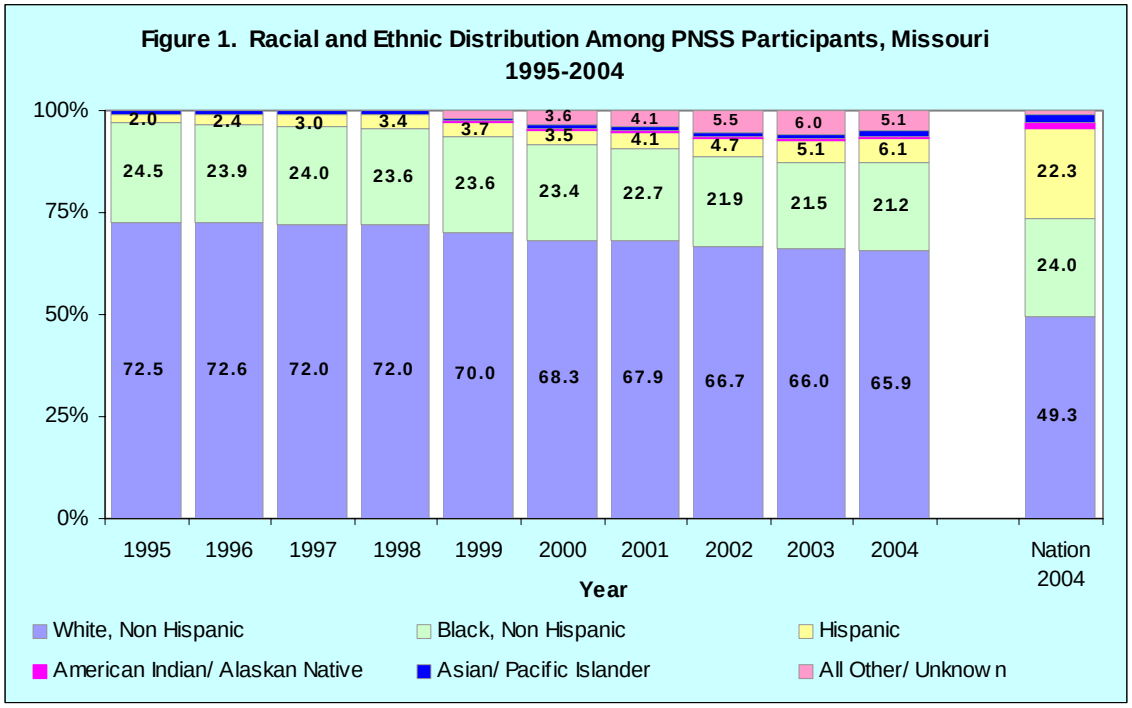
In Missouri, only the WIC program contributed to the PNSS, so the Missouri PNSS population does not represent all low-income women in the state (applicants must meet specific income guidelines and must be at nutritional risk to participate in WIC). Since not all states in the country participate in the PNSS, the “national” data do not reflect all such women in the United States, at least in part due to large demographic and other differences between or among states. Other limitations relate to continuity of service and information tracking and reporting. Some women served by WIC in Missouri during the pregnancy did not participate in WIC after delivery. Other women moved into or out of a service area while pregnant. Also, since women came to clinics at different times during and after their pregnancies, some women’s records were not complete when they were compiled and sent to CDC. Another complication was that CDC did not analyze data for any clinic or county reporting less than 100 cases.

Nevertheless, PNSS is a unique data set in that it is the largest, most diverse (racially, ethnically, and geographically) data set available on low-income pregnant women in the nation. The 2004 PNSS data represented 856,123 low-income women from 25 states and six tribal governments [1]. The contribution of only WIC data to the PNSS in Missouri allows easier application of the conclusions and recommendations to WIC-participating women. Thus, it helps determine risk factors and to enhance planning interventions to decrease infant mortality and poor birth outcomes among the state's low-income populations at health risk.

MATERNAL DEMOGRAPHIC CHARACTERISTICS

Race/Ethnicity

Race/Ethnicity data were analyzed because differences observed in racial and ethnic groups may reflect differences in their susceptibility or exposure to disease or a health problem, or the persistence of that disease or health problem.

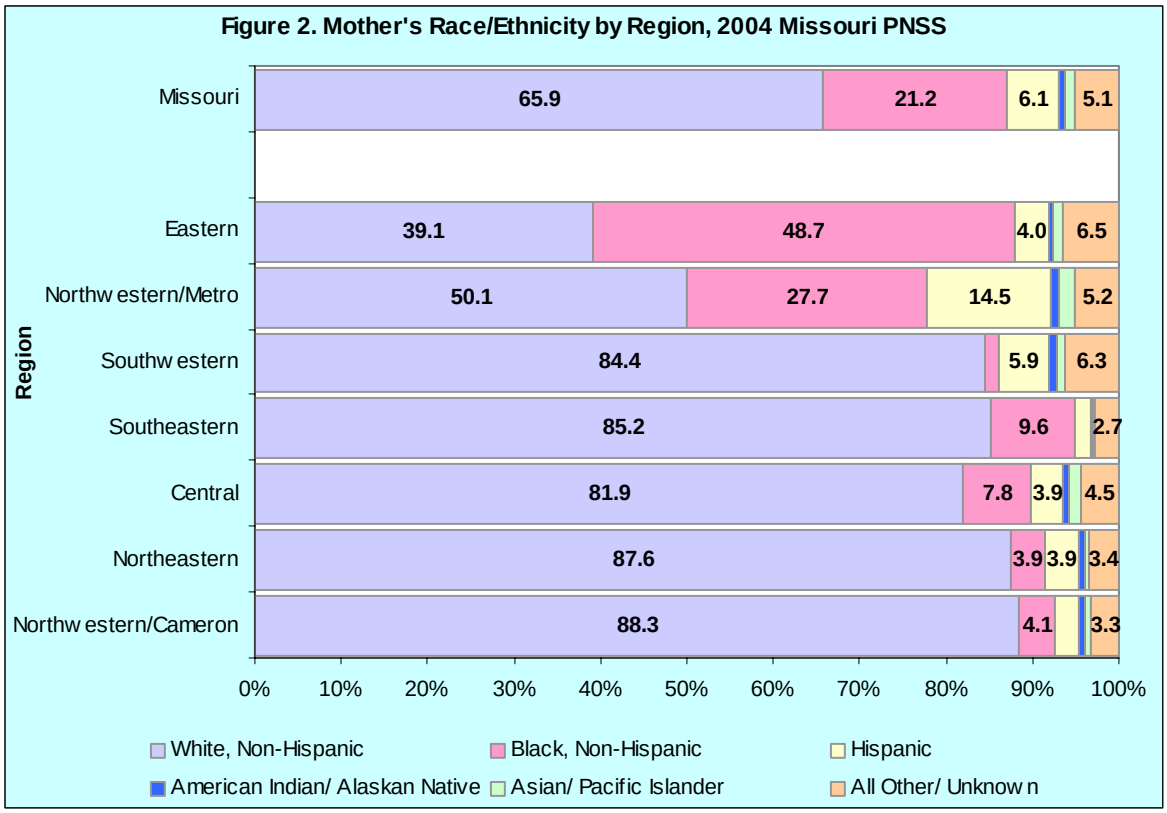


In Figure 1, a majority of the Missouri 2004 PNSS population included 65.9% White, Non Hispanic women, 21.2% Black, Non Hispanic women, 6.1% Hispanic women. During the past 10 years, the percentages of White and Black women in Missouri PNSS have decreased, while the percentage of Hispanic women in Missouri PNSS has increased from 2.0% to 6.1%. The proportion of the All Other/Unknown category was stable from 1995 to 1997 and equaled 0.0%. However, it increased from 0.1% in 1998 to 6.0% in 2003 and decreased to 5.1% in 2004.[1]

[1] The reason for the high percentage of the All Other/Unknown category in MO could be that a participant of Medicaid or other Missouri's special low-income programs begins WIC with an All Other/Unknown race/ethnicity. However, as of April 11, 2005, the system requires that WIC participants have no unknown values for race/ethnicity.

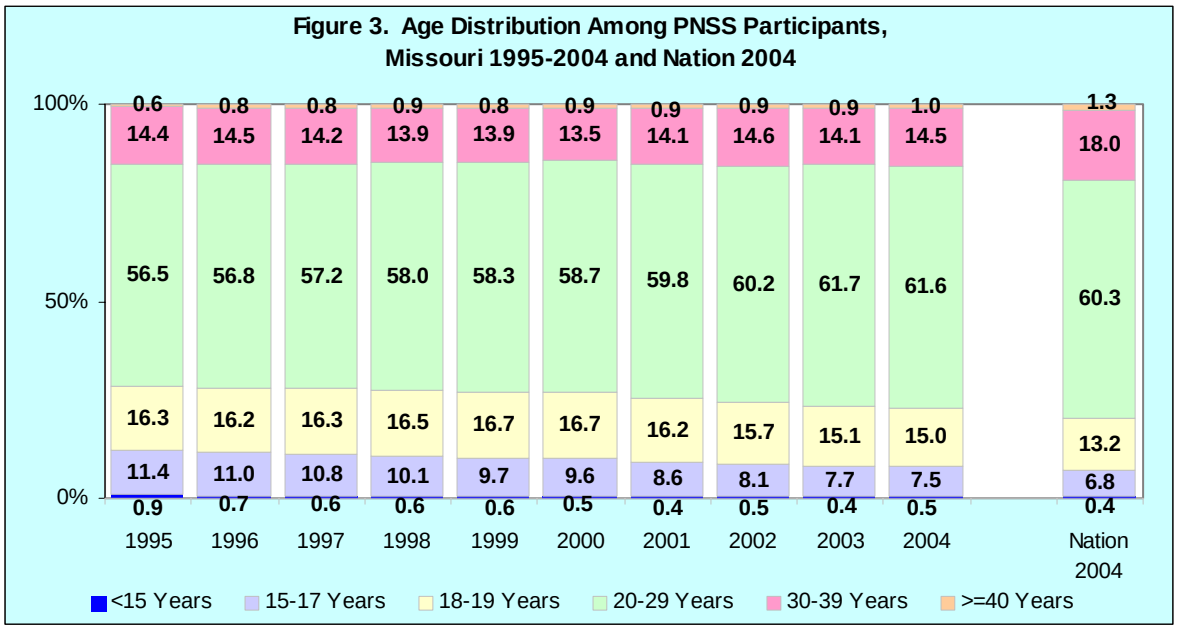
In the National 2004 PNSS, 49.3% of the participants were White, Non Hispanic, 24.0% Black, Non Hispanic, 22.3% Hispanic, 1.4% American Indian/Alaskan Native, 2.2% Asian/Pacific Islander, and 0.8% All Other/Unknown. The major difference between the National PNSS and the Missouri PNSS is that Missouri has a greater proportion of White, Non Hispanic women and the Nation has a greater proportion of Hispanic women.

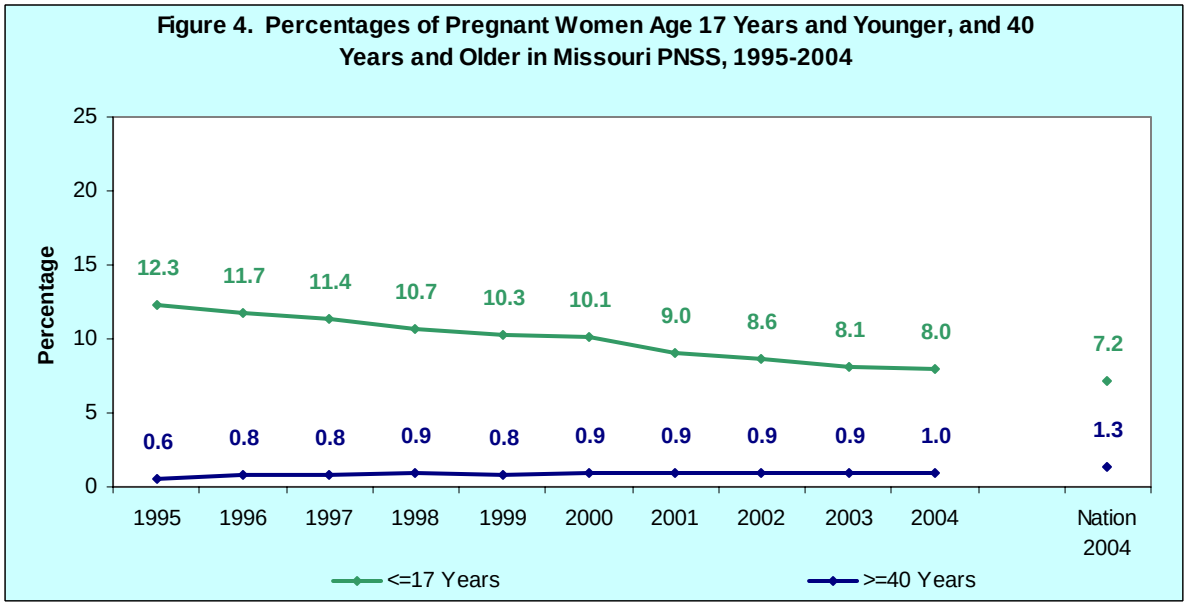
The racial and ethnic disparities among metropolitan and relatively rural regions were very large. For example, in the Northwestern/Cameron region, the proportion of White, Non Hispanic women was 88.3%, while in the Eastern region it was 39.1% (Figure 2). The region with the highest percentage of Hispanic women was Northwestern/Metro (14.5%). In the Eastern region, almost half of all PNSS participants were Black, Non Hispanic women, while in the Southwestern region, only 1.7% were Black, Non Hispanic women.



Age

The age of the mother can be considered a risk factor because the rates of some indicators vary with age. In Figure 3, 0.5% of women participating in the 2004 Missouri PNSS were younger than 15 years, 7.5% were in the 15-17 years age group, 15.0% were in the 18-19 years age group, 61.6% were in the 20-29 years age group, 14.5% were in the 30-39 years age group, and 1.0% were 40 years and older.





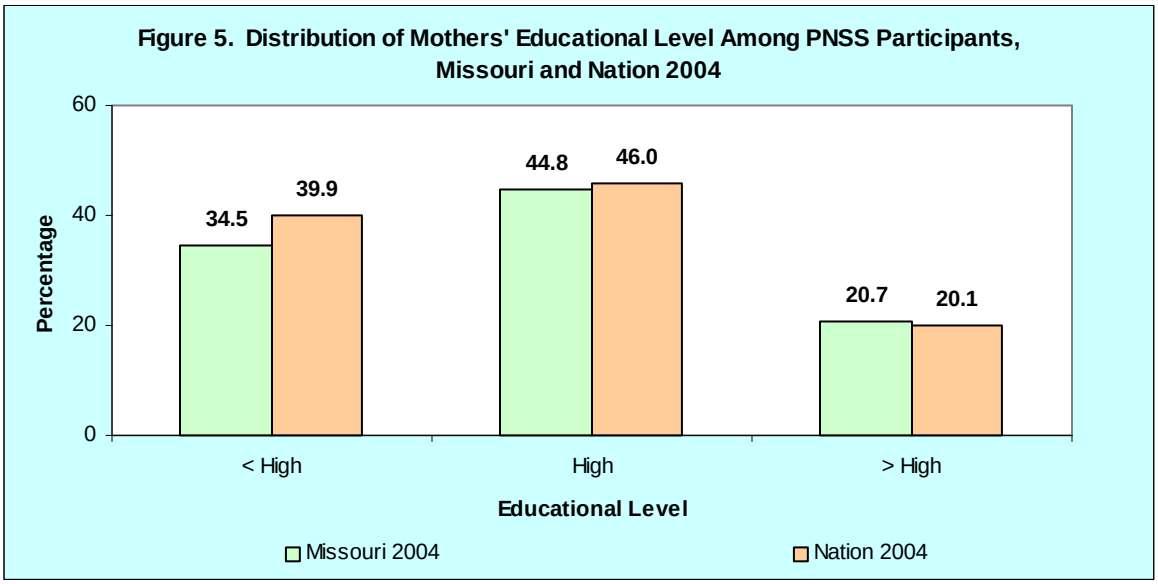
Note: Scale was set up from 0% to 25% to show the prevalence in more detail.

Teens (17 years and younger) and older women (40 years and older) were at greatest risk of poor birth outcomes [2]. Figure 4 shows that in the Missouri 2004 PNSS, 8.0% of pregnant women were teens but only 1.0% were older women. From 1995 to 2004, the proportion of

pregnant teens in Missouri PNSS decreased from 12.3% to 8.0%, while the proportion of pregnant women who were 40 years and older has remained fairly stable.

Education

Educational level among PNSS participants can be used as an indirect measure for socioeconomic status. Also, educational level can be important in relation to indicators, such as smoking habits and breastfeeding initiation. In Figure 5, out of the Missouri 2004 PNSS participants, 20.7% had completed greater than high school education, 44.8% had completed high school, and 34.5% had not received a high school education. The percentage of women with high school and greater than high school education participating in the Missouri 2004 PNSS in 2004 was similar to the average of all states contributing to the system in 2004.



Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

Poverty Level/Migrant Status

The vast majority (67.9%) of PNSS participants in Missouri in 2004 reported household income at 0-100% of the federal poverty level, while 30.5% reported household income at 101-200% of the federal poverty level. Nationally, 67.7 % of all women participating in the 2004 PNSS were at household income levels less than or equal to 100% of the federal poverty level, and 29.8% reported household incomes at 101-200% of the federal poverty level.

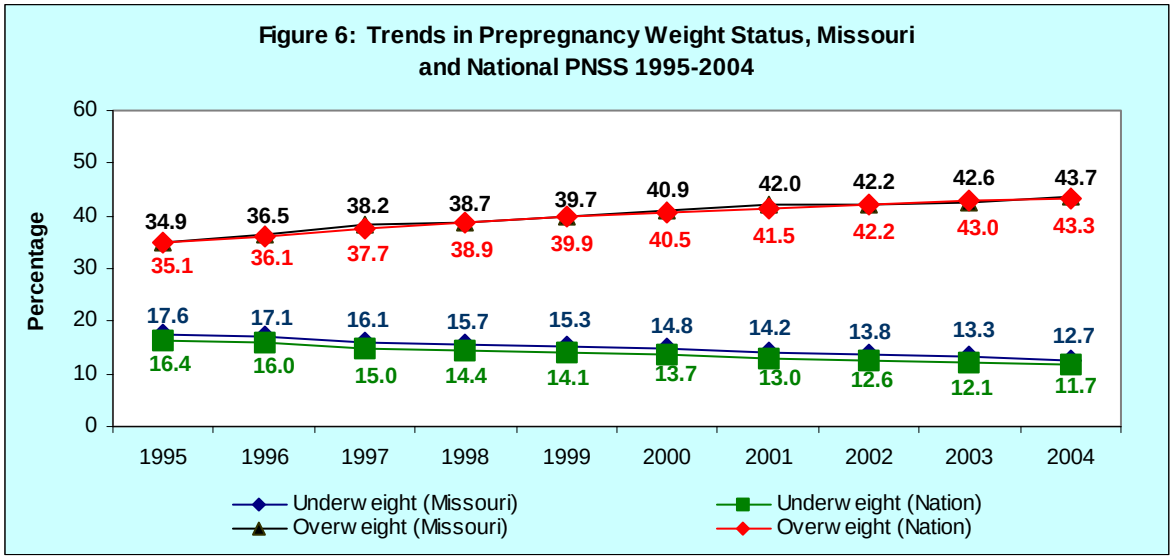
A small number (10) of the Missouri PNSS participants reported that they were migrants in 2004, compared to 6,766 among PNSS participants in all states participating in the surveillance system in 2004.

MATERNAL HEALTH AND BEHAVIORAL HEALTH INDICATORS

Prepregnancy Weight Status[2]

Prepregnancy weight is an indicator of the nutritional status of a woman before she becomes pregnant [3] and is a major factor affecting birth weight and therefore, health of the newborn and the mother [4]. An association between prepregnancy weight and birth weight was documented as early as the 1950s and has been confirmed in more recent studies [5]. Prepregnancy underweight can be a determinant of low birthweight, preterm, and full term low birthweight, while prepregnancy overweight and obesity are associated with delivery of a high birthweight infant and cesarean section delivery. An association between prepregnancy weight and stillbirth has been reported, with the lowest risk among normal weight women and the highest risk among overweight women [6].

In the PNSS, prepregnancy weight status was determined by the body mass index (BMI[3]). In WIC clinics, self-reported prepregnancy weight and measured height are used to calculate prepregnancy BMI and then, according to the prepregnancy BMI, women are classified into one of four weight categories specified by the Institute of Medicine [7]: underweight, normal weight, overweight, and obese. In Figure 6, the percentage of women in the Missouri PNSS with low prepregnancy weight has been decreasing from 17.6% in 1995 to 12.7% in 2004. By contrast, the prevalence of prepregnancy overweight has been increasing from 34.9% to 43.7%.[4]

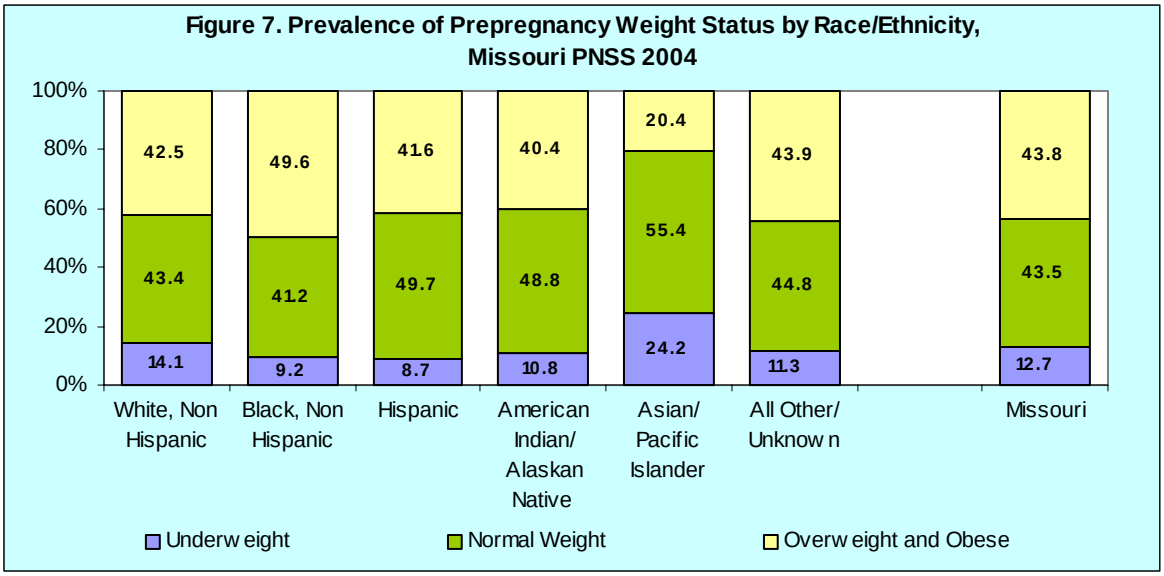


Note: Scale was set up from 0% to 60% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

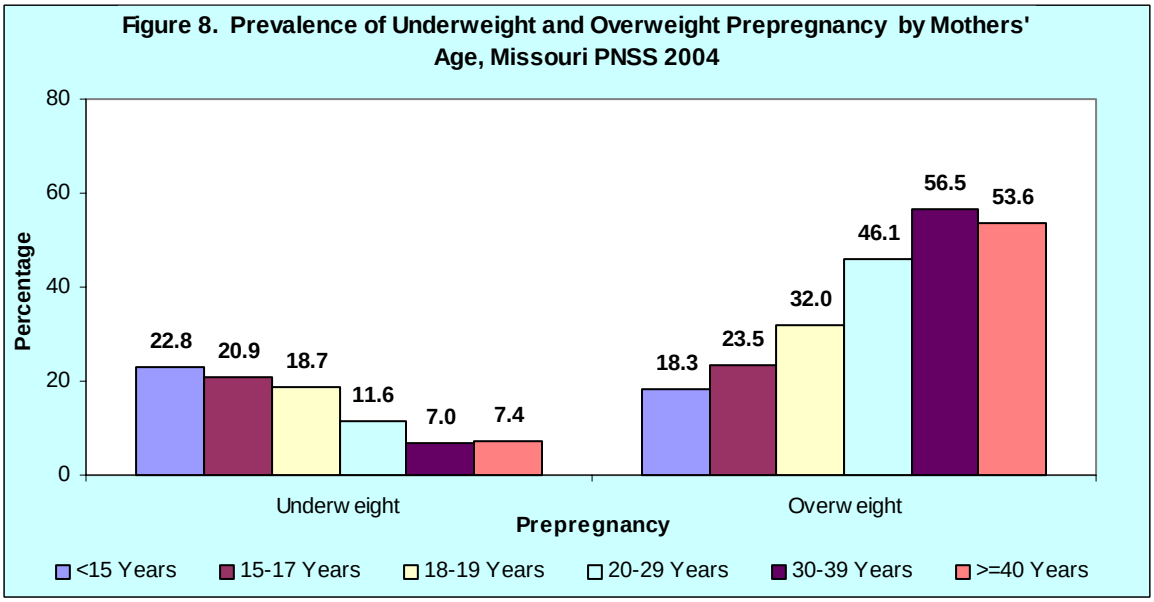
[2] Refer to the maps in Appendix 1 to see prevalence of prepregnancy underweight by county, and Appendix 2 for prevalence of prepregnancy overweight by county (Missouri PNSS 2002-2004 combined years)

[3] BMI uses a mathematical formula that takes into account both a person's height and weight. BMI equals a person's weight in kilograms divided by height in meters squared. ($BMI=kg/m^2$)

[4] The PNSS trend data of Missouri cannot be directly compared with that of the nation since Missouri and the nation had different distributions of women on race/ethnicity.

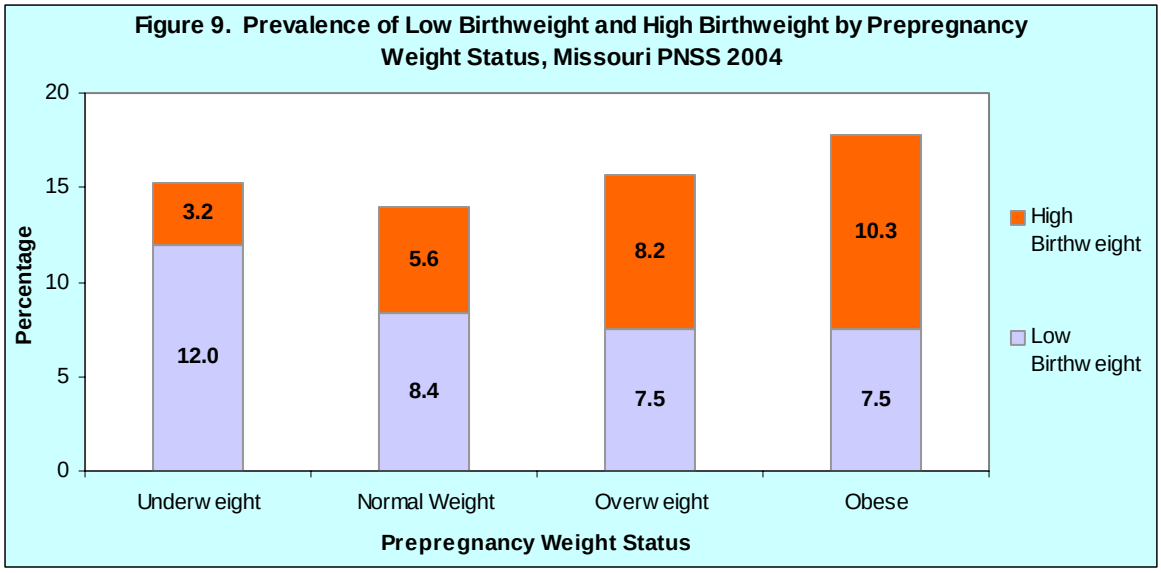


In the Missouri 2004 PNSS, the highest percentage of underweight prior to pregnancy (24.2%) was among Asian/Pacific Islander women (Figure 7). Also, Asian/Pacific Islander women were more likely to have normal weight during the prepregnancy period (55.4%) compared to women of other racial and ethnic groups. Black, Non Hispanic PNSS participants in 2004 were most likely to be overweight (49.6%) before pregnancy and least likely to have normal weight (41.2%) prior to pregnancy. The Hispanic race/ethnicity had the lowest percentage of women who were underweight (8.7%) prior to pregnancy.



Note: Scale was set up from 0% to 80% to show the prevalence in more detail.

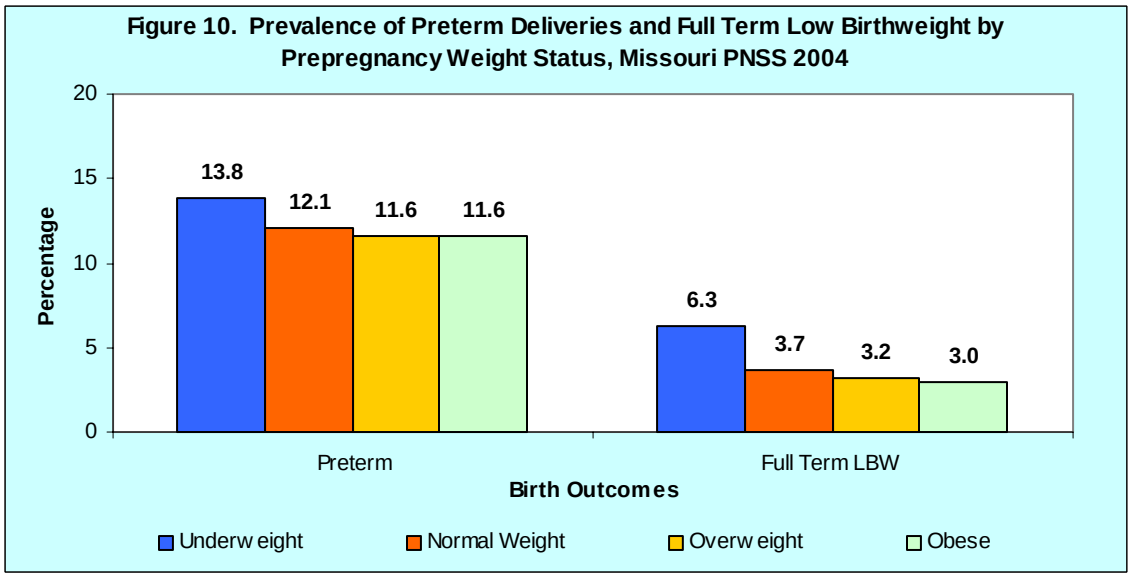
In Figure 8, women aged 19 years and younger were more likely to be underweight before pregnancy. Prepregnancy overweight prevalence was over 50% among women 30 years and older. The Missouri 2004 PNSS prepregnancy underweight and overweight rates showed an almost linear association with age and prepregnancy weight status.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

In the Missouri 2004 PNSS, women who were underweight before pregnancy were more likely to deliver a low birthweight baby (12.0%) compared to women who were normal weight or overweight (8.4% and 7.5%, respectively) (Figure 9). Comparatively women who were obese before pregnancy were over 2 times more likely to have a high birthweight infant (10.3%) than those that were normal weight (5.6%).

In Figure 10, the prevalence of delivering a preterm or full term low birthweight (LBW) baby was higher among women who were underweight prior to pregnancy (13.8% of preterm deliveries and 6.3% of full term LBW) than among women who were normal weight (12.1 % of preterm deliveries and 3.7% full term LBW) and overweight (11.6% of preterm deliveries and 3.2% full term LBW) prior to the pregnancy.



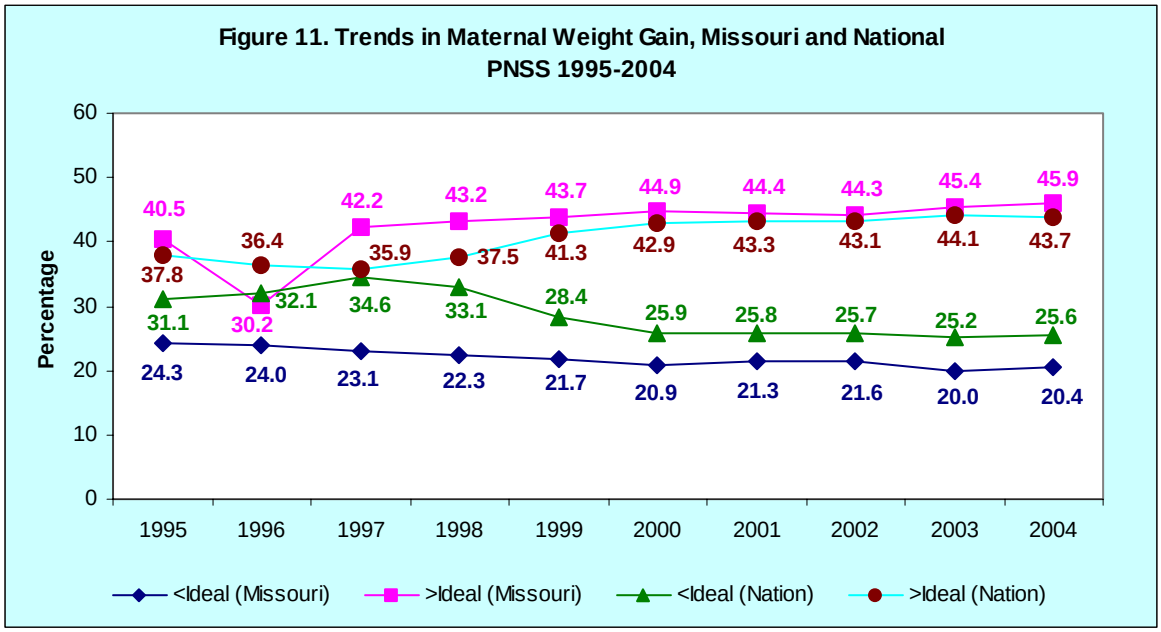
Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

Maternal Weight Gain[5]

Maternal (gestational) weight gain refers to the amount of weight gained from conception to delivery. The Institute of Medicine (IOM) recommends higher weight gain for women with a low prepregnancy weight than for women with a high prepregnancy weight: 28-40 pounds (lbs) for underweight women, 25-35 lbs for normal weight women, 15-25 lbs for overweight women, and at least 15 lbs for obese women [8].

Gestational weight gain in full-term pregnancies is the most significant predictor of birth weight and infant morbidity and mortality. Less than ideal gestational weight gain is associated with lower than average fetal growth; while greater than ideal gestational weight gain increases the risk of cesarean deliveries, spontaneous preterm delivery and is associated with neonatal complications [9]. Adequate gestational weight gain is affected by many factors, some of which are within the woman's control such as the nutritional quality of foods she eats and whether or not she smokes during pregnancy [10]. Other risk factors that affect adequate gestational weight gain are genetics, age, ethnic background, and income [11]. All of these factors can be taken into consideration and addressed by WIC agencies.

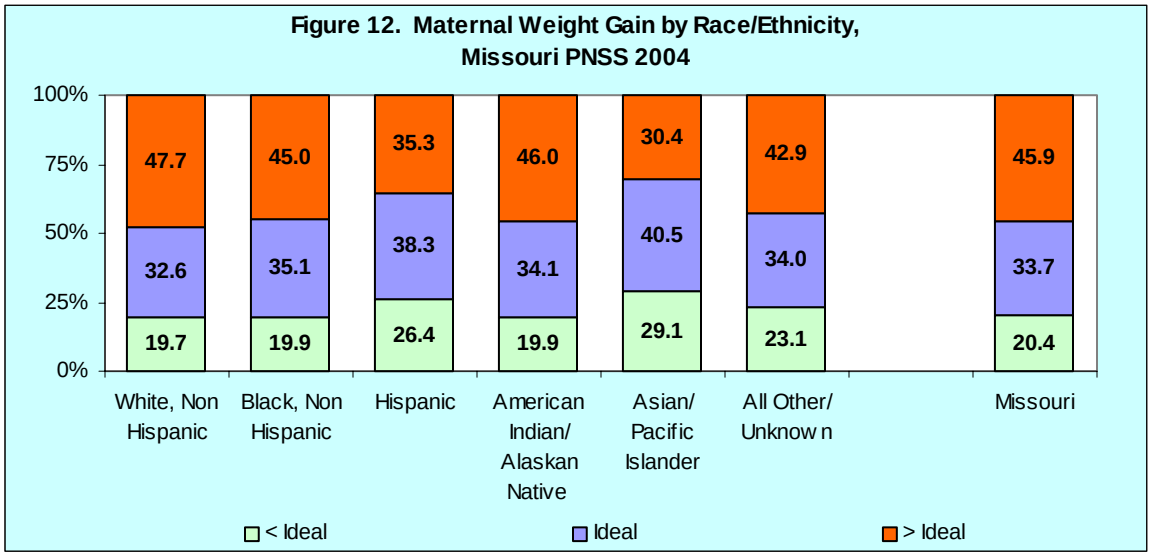
In the Missouri PNSS, the percentage of less than ideal and greater than ideal weight gain during pregnancy has been relatively stable from 1997 to 2004 (Figure 11). The highest rate of greater than ideal gestational weight gain was reported in 2004 (45.9%). However, the percentage of less than ideal gestational weight gain in 2004 (20.4%) has increased slightly from 2003 (20.0%), the lowest registered since 1995.



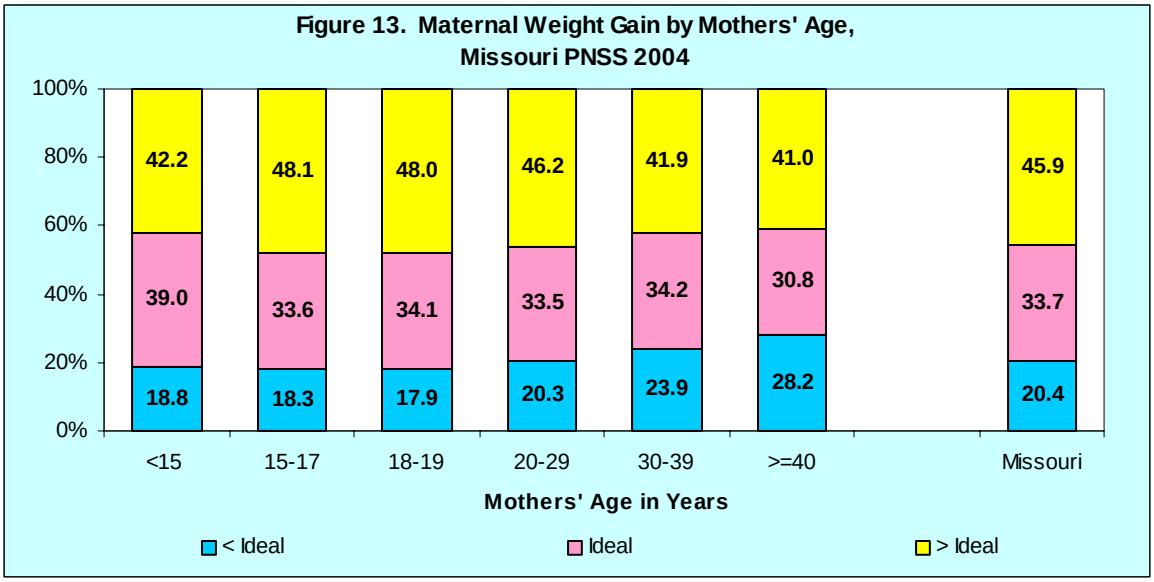
Note: Scale was set up from 0% to 60% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

[5] Refer to the maps in Appendix 3 to see prevalence of less than ideal maternal weight gain by county, and Appendix 4 for prevalence of greater than ideal weight gain by county (Missouri PNSS 2002-2004 combined years)

In the Missouri PNSS 2004, the majority of women (66.3%) did not gain adequate weight during pregnancy (20.4% gained less than ideal and 45.9% greater than ideal). Figure 12 shows that the prevalence of women with greater than ideal gestational weight gain was highest among White, Non Hispanic women (47.7%) and lowest among Asian/Pacific Islander women (30.4%). Conversely the prevalence of ideal weight gain during pregnancy among the Missouri 2004 PNSS population was lowest among White, Non Hispanic women (32.6%) and highest among Asian/Pacific Islander women (40.5%), compared to all other racial and ethnic groups.



In Figure 13, 15-17 year old women were more likely to gain greater than ideal weight during pregnancy (48.1%) while older women (40 years and older) were more likely to gain below ideal weight (28.2%), compared to all other age groups (Figure 13). Very young women (less than 15 years) showed the largest proportion of adequate maternal weight gain (39.0%).



In Figure 14, only 25.3% of women who were overweight before pregnancy gained ideal gestational weight, while a majority (65.7%) gained greater than ideal gestational weight. The

highest percentage of women (42.0%) with ideal gestational weight gain was in the group of women with low prepregnancy weight.

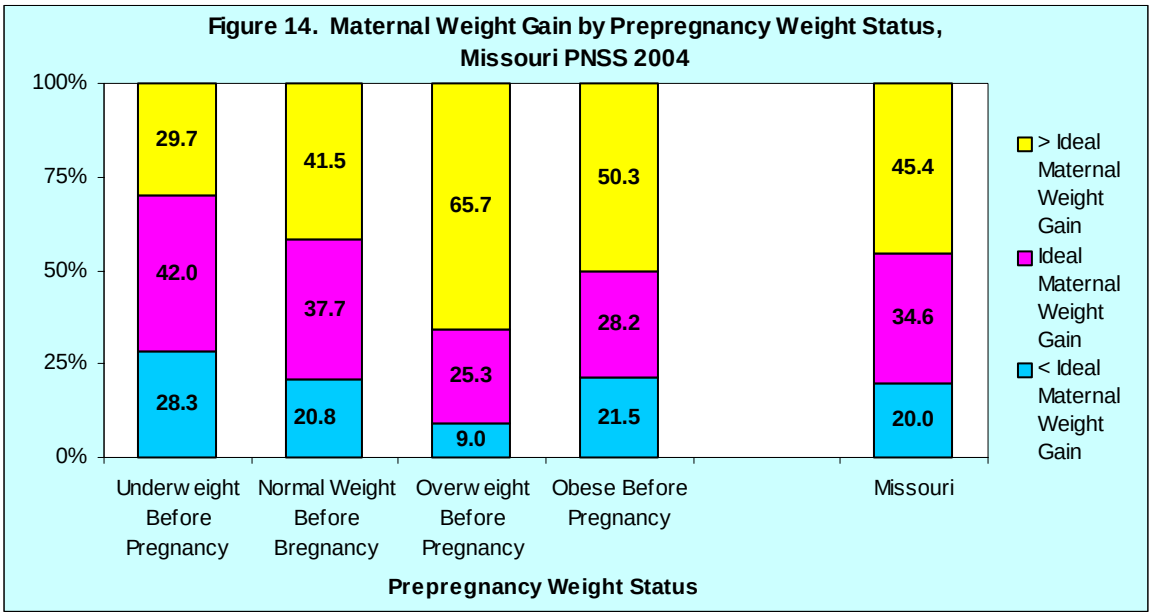
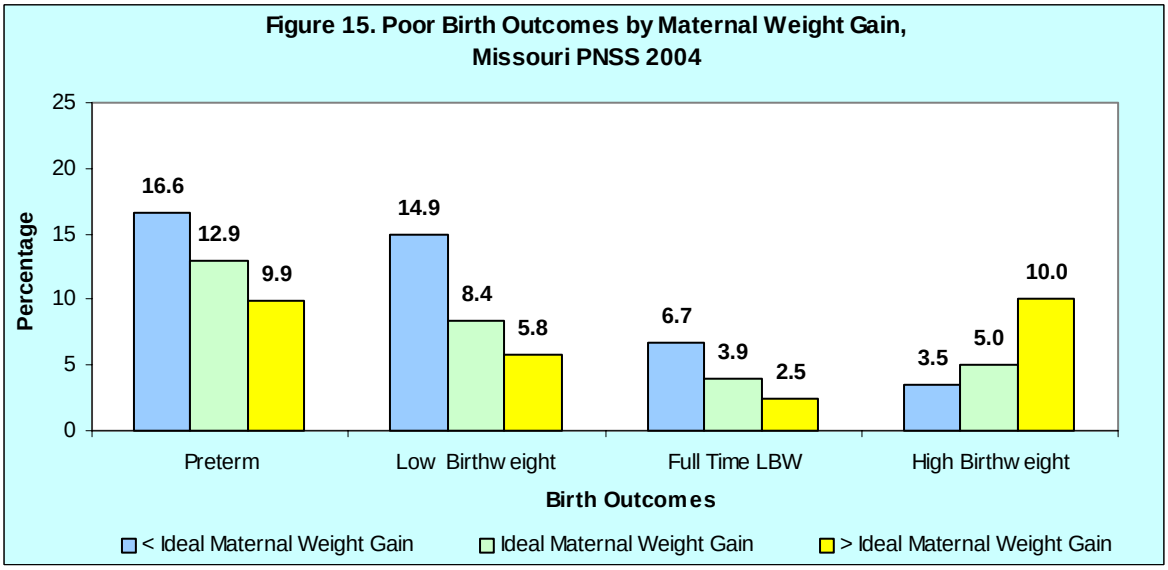


Figure 15 shows that women who gained less than ideal weight during pregnancy were more likely to deliver preterm (16.6%), low birthweight (14.9%), and full term low birthweight (6.7%) babies than women who gained the ideal weight during pregnancy (12.9%, 8.4%, and 3.9%, respectively). On the other hand, women who gained greater than ideal weight were more likely to have an infant with high birthweight (10.0%) than women who gained the ideal (5.0%) or less than ideal (3.5%) weight during pregnancy.



Note: Scale was set up from 0% to 25% to show the prevalence in more detail.

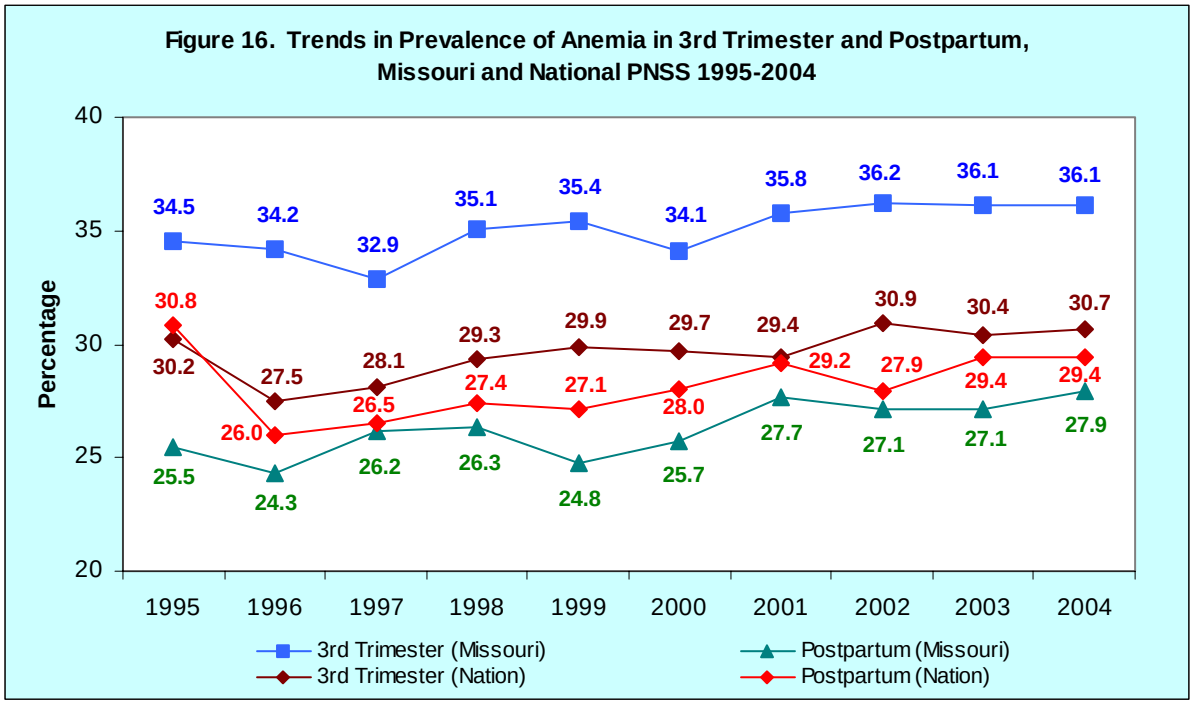
Maternal Anemia[6]

The determination of anemia (low hemoglobin/hematocrit) is based on CDC's recommendations to prevent and control iron deficiency in the United States [12].

Causes of iron deficiency anemia in pregnant women are numerous and multifaceted. Iron-poor diet has been considered as the major cause of this disorder [13]. Cigarette smoking is a risk factor for having low hemoglobin/hematocrit, because it decreases absorption of micronutrients in the intestine [14]. That is one reason iron deficiency and iron deficiency anemia can be treated with an excellent outcome [15]. Treatment may include an iron-rich diet, iron supplements and multivitamin consumption [16].

Iron deficiency anemia during the first two trimesters of pregnancy has been associated with inadequate gestational weight gain, a double risk for preterm delivery, and a 3 times higher risk for delivering a low-birth infant [17]. Longitudinal studies have shown that the highest prevalence of anemia during pregnancy is in the third trimester [18]; therefore, the Healthy People 2010 Objective monitors the prevalence of anemia during the third trimester of pregnancy. This objective seeks to reduce the percentage of low-income women with anemia in the third trimester to 20% by 2010.

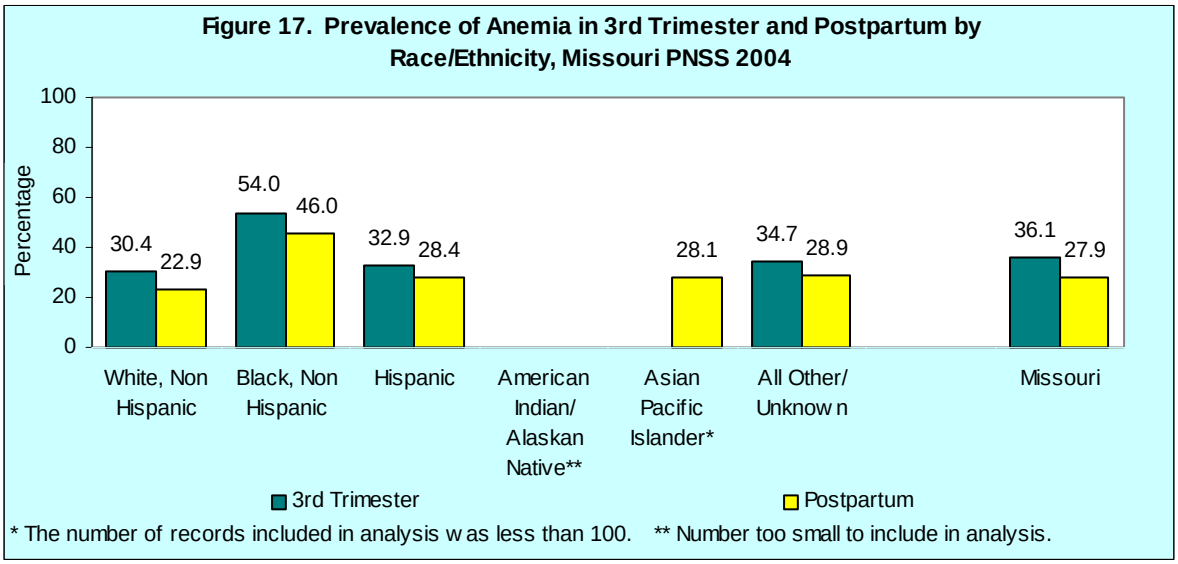
In Figure 16, the prevalence of anemia among women participating in the Missouri 2004 PNSS during the 10 previous years has remained stable overall for women in the 3rd trimester and postpartum women.

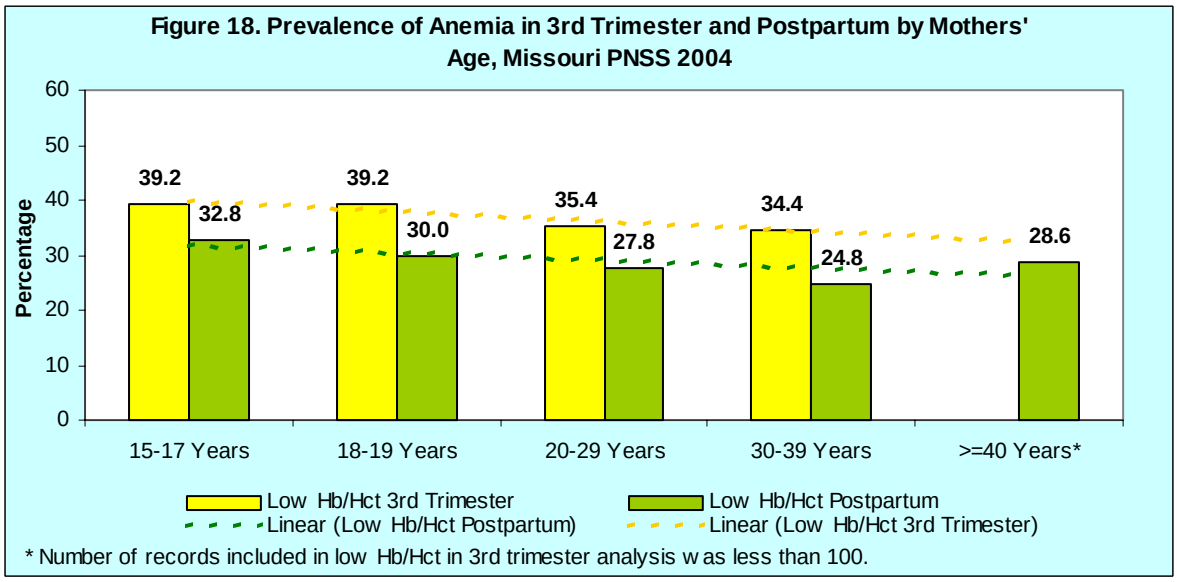


Note: Scale was set up from 20% to 40% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

[6] Refer to the maps in Appendix 5 to see prevalence of low hemoglobin/hematocrit in 3rd trimester of pregnancy by county, and Appendix 6 for prevalence of low hemoglobin/hematocrit postpartum by county (Missouri PNSS 2002-2004 combined years)

The prevalence of anemia in the 3rd trimester in the Missouri 2004 PNSS varied among racial and ethnic groups (Figure 17)[7]. Black, Non Hispanic women were at a higher risk compared to all other racial and ethnic groups. More than half (54.0%) of Black, Non Hispanic participants were diagnosed anemia during the 3rd trimester, which was 1.8 times greater than the prevalence for White, Non Hispanic women (30.4%). Black, Non Hispanic women had low hemoglobin or hematocrit (46.0%) after delivery, which was 2.0 times greater than White, Non Hispanic Missouri PNSS participants (22.9%)[8].





Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

[7] The American Indian/Alaskan Native group is not presented in the figure since less than 100 records were available for analysis after exclusion.

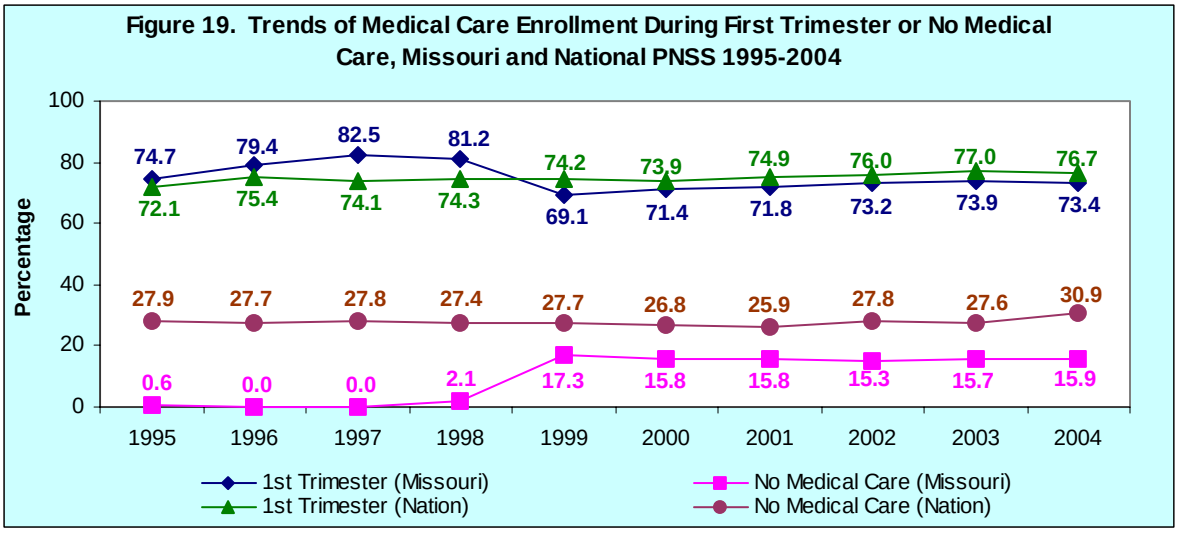
[8] Many studies have shown a higher prevalence of iron deficiency anemia in Black, Non Hispanic women. One of the explanations could be a difference in dietary habits (Siega-Ritz AM, Bodnar LM, Savitz DA, Am J Obstet Gynecol. 2002 Mar;186 (3). Also a significant hemoglobin difference for Black, Non-Hispanic and White, Non Hispanic women was related to a different relationship between hemoglobin and transferrin saturation for the two racial groups (Meyers LD, Habicht JP, Johnson CL. Am J Epidemiol. 1979 May: 109(5)).

Another indicator associated with the percentage of anemia among PNSS participants is age. In Figure 18, the highest prevalence of anemia in 2004 Missouri PNSS participants were in women age 15-19 years (39.2% in the 3rd trimester). However, the highest prevalence (32.8%) of anemia after delivery was in women age 15-17 years. During the third trimester of pregnancy, the prevalence of anemia slightly decreased with increasing age, starting with the 20-29 years old. During the postpartum period there was a decrease in the prevalence of anemia with increasing age from 32.8% among 15-17 years old women to 24.8% in 30-39 years old women.

Medical Care[9]

Prenatal care has long been endorsed as a means to identify mothers at risk of delivering a preterm or growth-retarded infant and to provide an array of available medical, nutritional, and educational interventions intended to reduce the determinants and incidence of low birthweight and other adverse pregnancy conditions and outcomes. Women who begin prenatal care after the first trimester are at a higher risk for poor pregnancy outcomes with infants being born premature, low birthweight or growth retarded [19]. One of the Healthy People 2010 Objectives is to increase the percentage of women receiving prenatal care beginning in the first trimester of pregnancy to 90%.

Medical care in the PNSS indicates the month in which prenatal care began for the current pregnancy. Medical care data were collected at the prenatal and postpartum visits. However a PNSS participant would only have postpartum data if she was not enrolled in the WIC program during her pregnancy or if she reported at the prenatal visit that she had not begun medical care. In Figure 19, almost three fourths of Missouri PNSS participants in 2004 received medical care during the first trimester of pregnancy, and the proportion of women not receiving medical care during the first trimester fluctuated somewhat during the time frame between 1999 (17.3%) and 2004 (15.9%).

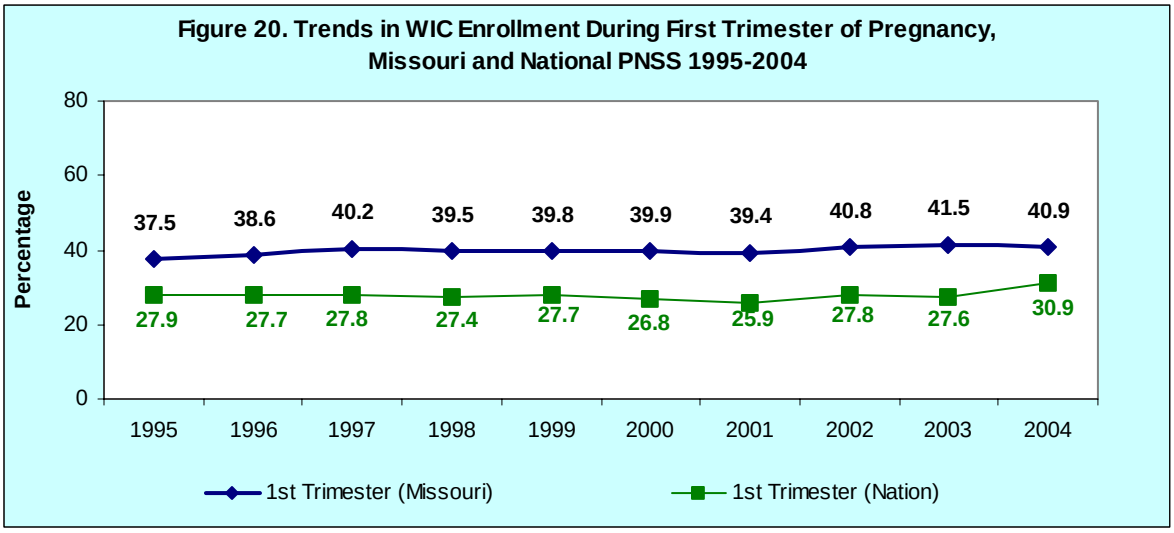


Note: It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

[9] Refer to the map in Appendix 7 to see the percentage of WIC participating women with no medical care during pregnancy (Missouri PNSS 2002-2004 combined years)

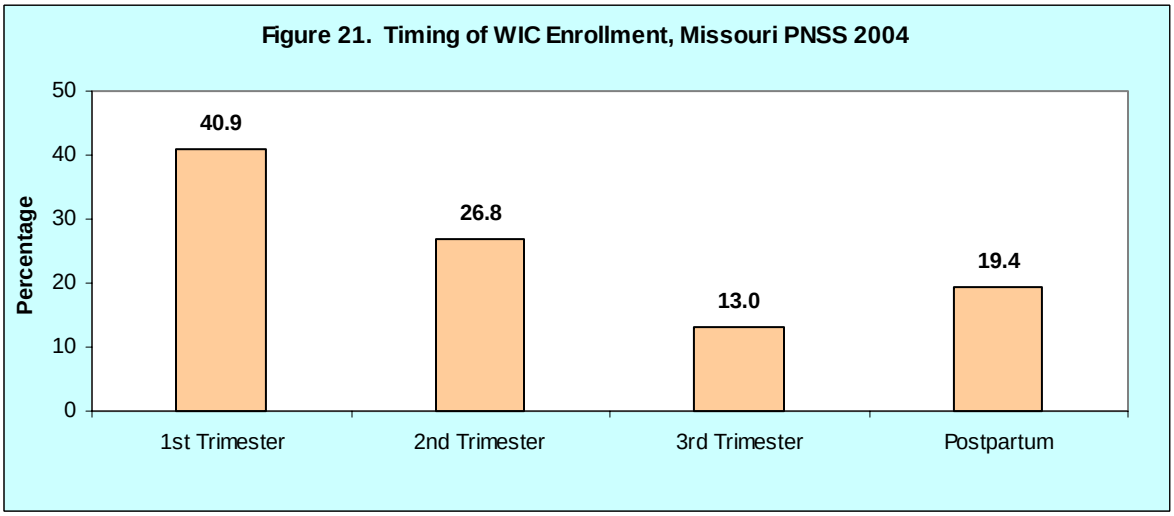
WIC Enrollment[10]

A number of studies have shown that enrollment in WIC is associated with a lower prevalence of small-for-gestational-age deliveries [20] and reduction of preterm delivery [21]. In addition, longer enrollment in the WIC program was associated with a reduced risk of low birthweight. Women who participated in WIC showed better dietary intake and prenatal weight gain than those who did not [22]. The percentage of women in Missouri entering WIC during the first trimester of pregnancy fluctuated between 37.5% and 41.5% during the last 10 years (Figure 20).



Note: Scale was set up from 0% to 80% to show the prevalence in more detail. It is advised that trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

In the Missouri 2004 PNSS, the percentage of women who enrolled in the WIC program during the first trimester of pregnancy was higher than in the 2nd and 3rd trimesters, or postpartum (Figure 21).

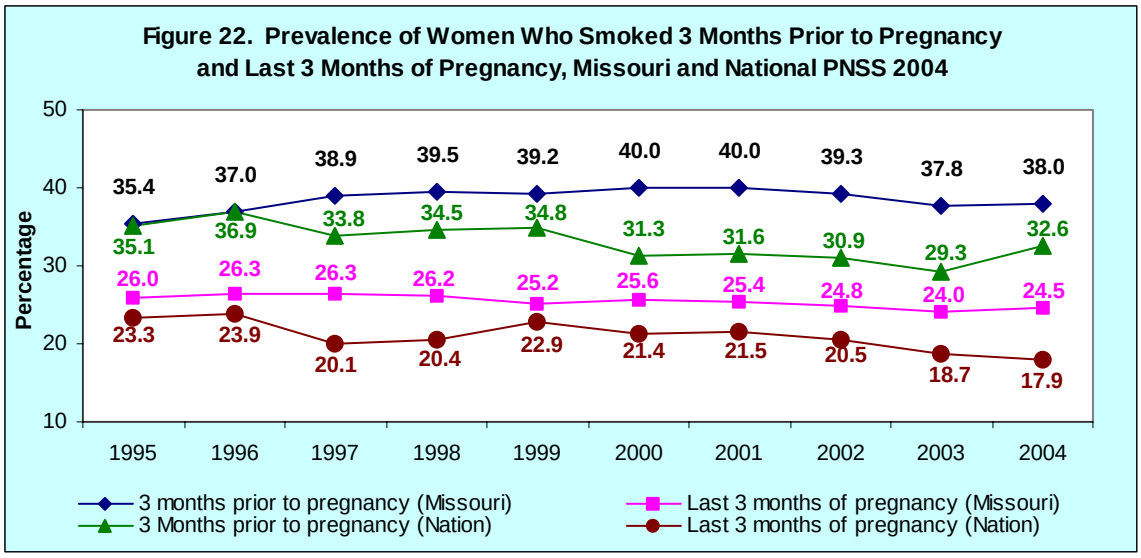


Note: Scale was set up from 0% to 50% to show the prevalence in more detail.

[10] Refer to the map in Appendix 8 to see the percentage of women enrolling in WIC during 1st trimester of pregnancy by county (Missouri PNSS 2002-2004 combined years)

Smoking During Pregnancy[11]

Smoking during pregnancy increases the risk of miscarriage, preterm birth, and infant death, including sudden infant death syndrome (SIDS or "crib death"). It is widely known that women who smoke during pregnancy are more likely to have low birthweight infants.

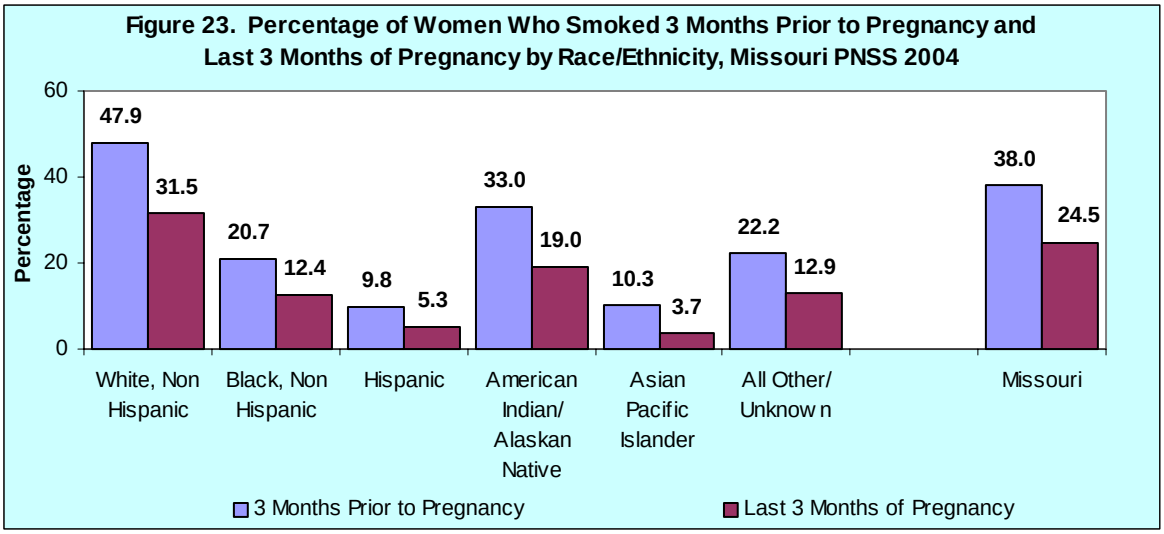


Note: Scale was set up from 10% to 50% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

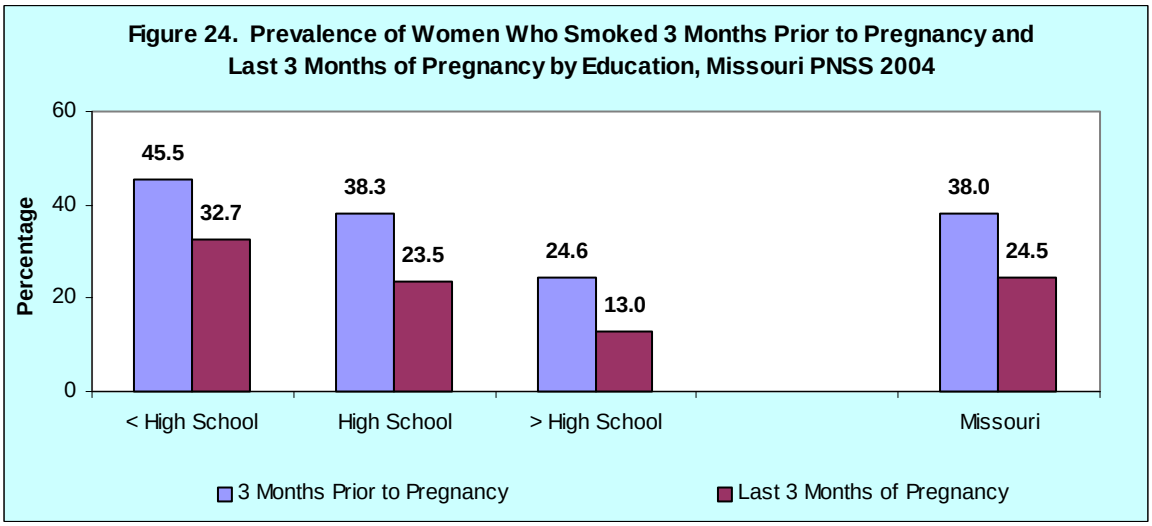
In the Missouri 2004 PNSS, the percentage of women who did not smoke during pregnancy and had low birthweight infants was 7.2%, but the percentage of women who smoked and had low birthweight infants was 10.2%. Figure 22 shows the 10-year trends (1995-2004) of the percentage of women in the WIC program who smoked 3 months prior to pregnancy and the last 3 months of pregnancy. The lowest rate (35.4%) of smoking 3 months prior to pregnancy was 1995. Since that year, the rate for this indicator continued to increase to a high of 40% in 2000 and 2001, decreased in 2002 (39.3%) and in 2003 (37.8%), but increased in 2004 (38.0%).

In comparison, the trend for WIC women who smoked the last 3 months of pregnancy is more stable. Figure 22 shows that each year, about one third of WIC women who smoked 3 months prior to pregnancy quit smoking after they were aware of their pregnancy. However, there were still about one fourth of the WIC pregnant women who smoked during the last three months of pregnancy each year from 1995 to 2004. The 2010 Healthy People Objective is to reduce the rate of cigarette smoking during the last 3 months of pregnancy to 1%. Figure 23 shows that White, Non Hispanic women in WIC had the highest rate of smoking 3 months prior to pregnancy (47.9%), while Hispanic women had the lowest rate (9.8%).

[11] Refer to the map in Appendix 9 to see percentage of women who smoked last 3 months of pregnancy by county (Missouri PNSS 2002-2004 combined years)



Note: Scale was set up from 0% to 60% to show the prevalence in more detail.



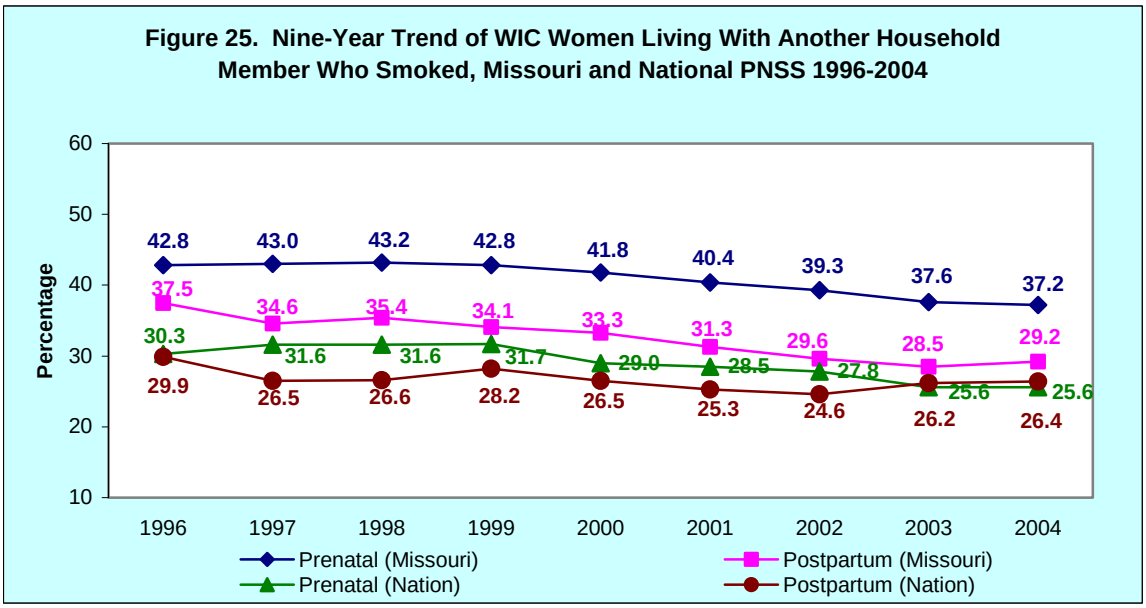
Note: Scale was set up from 0% to 60% to show the prevalence in more detail.

Educational level also had a strong impact on WIC women's smoking behaviors. The higher the level of education that a WIC woman had received, the less likely she would smoke prior to or during pregnancy. Figure 24 shows that the rates of WIC women who smoked 3 months prior to pregnancy and the last 3 months of pregnancy were highest among those who had less than a high school education (45.5% and 32.7%, respectively). In contrast, the rates for those who had greater than a high school education were lowest on these two indicators (24.6% and 13.0%, respectively).

Secondary Smoke from Other Household Members

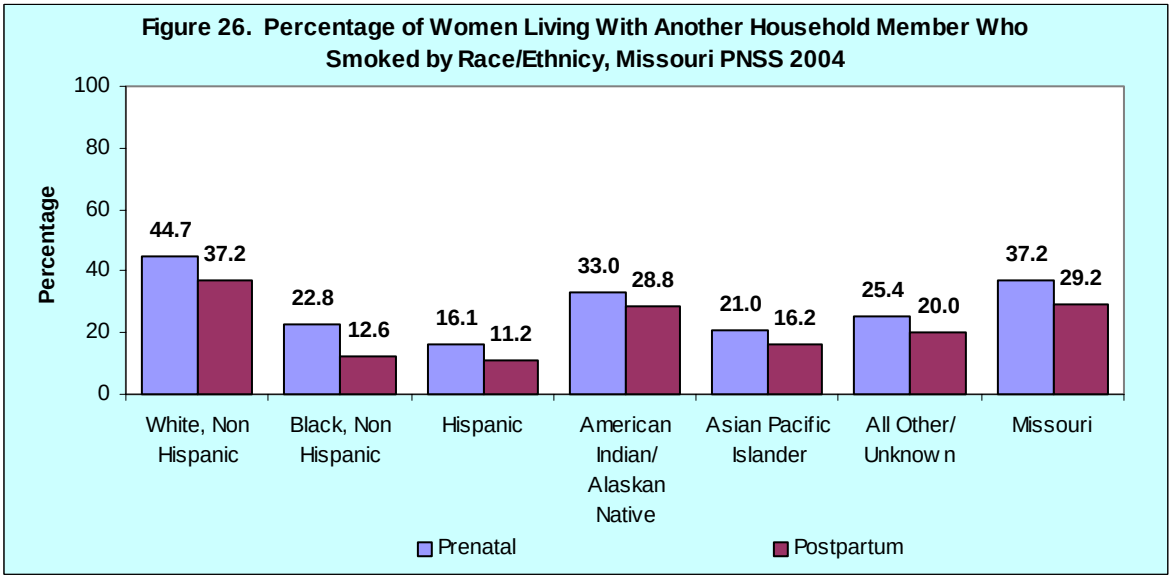
Secondary smoke from other household members is also unhealthy during pregnancy, and after birth as well. Infants exposed to secondary smoke are more likely to have respiratory infections and colds. In Figure 25, the 9-year trend data (data were not available prior to 1996 on this indicator) show that before 2002, more than 40% of WIC women in the prenatal period and more than 30% of WIC women in the postpartum period lived with other household members

who were smokers. The prevalence of these two indicators decreased to 37.2% and 29.2% respectively in 2004.

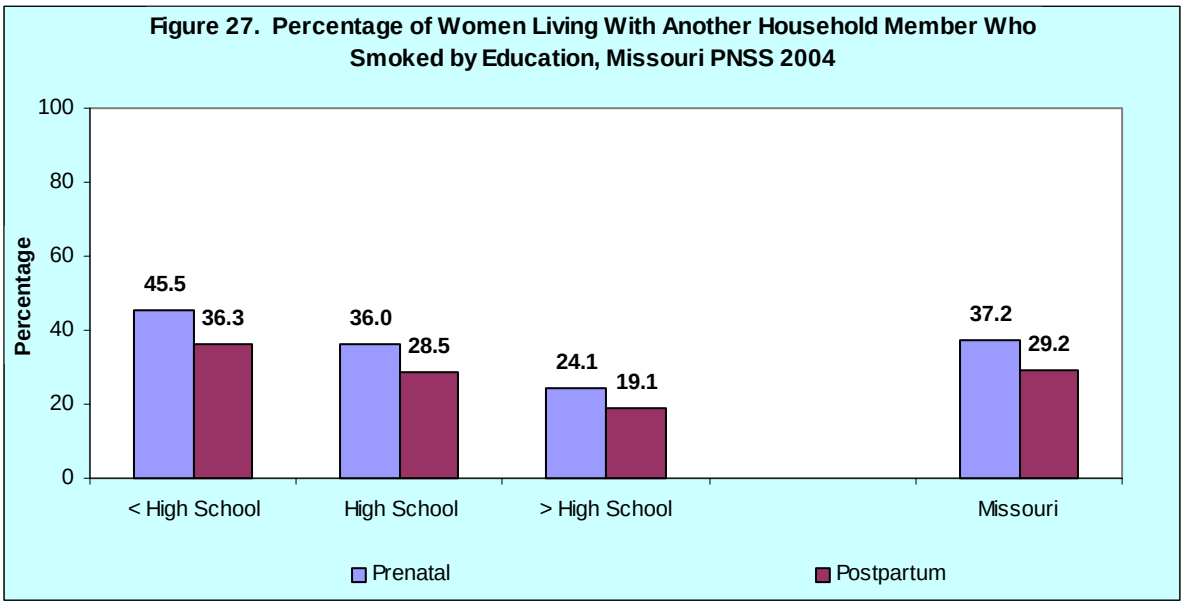


Note: Scale was set up from 10% to 60% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

Similar to smoking during pregnancy, race/ethnicity had an impact on the rate of smoking from other household members. Figure 26 shows that during pregnancy, a higher percentage of White, Non Hispanic women (44.7%) and American Indian/Alaskan Native women (33.0%) than other racial ethnic groups lived with another household member who smoked. Comparatively a lower percentage of Hispanic women (16.1%) lived households with another member who smoked. The percentage of postpartum women living in households with another member who smoked was still highest for the White, Non Hispanic (37.2%) and lowest for Hispanic (11.2%).



WIC women's educational level also had an impact on the rate of secondary smoking in the household. Figure 27 shows that the higher the educational level of a WIC woman, the less likely this woman would be living with another household member who smokes.



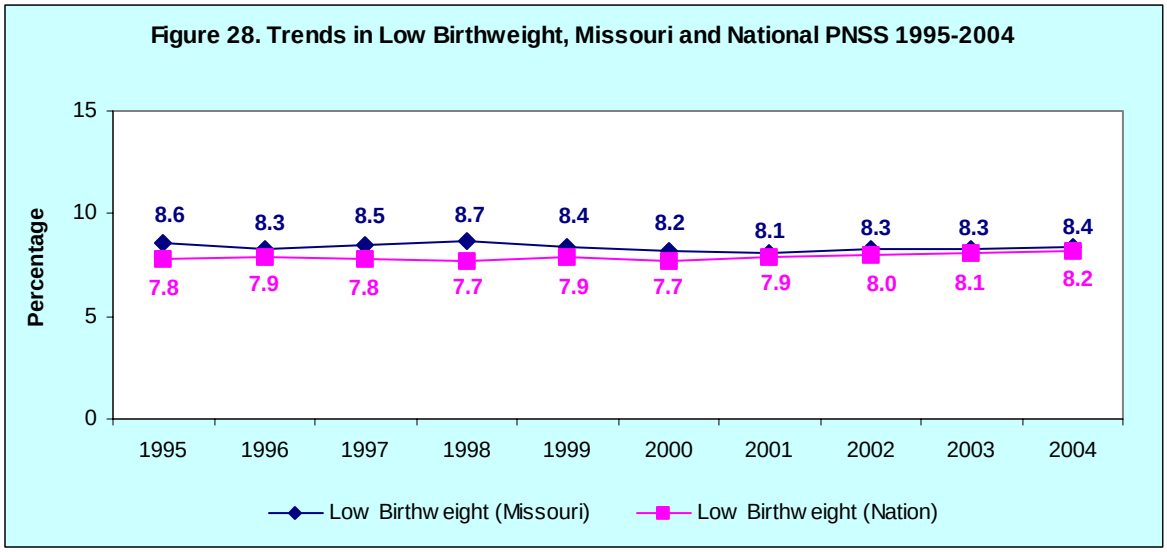
INFANT HEALTH INDICATORS

Low or High Birthweight[12]

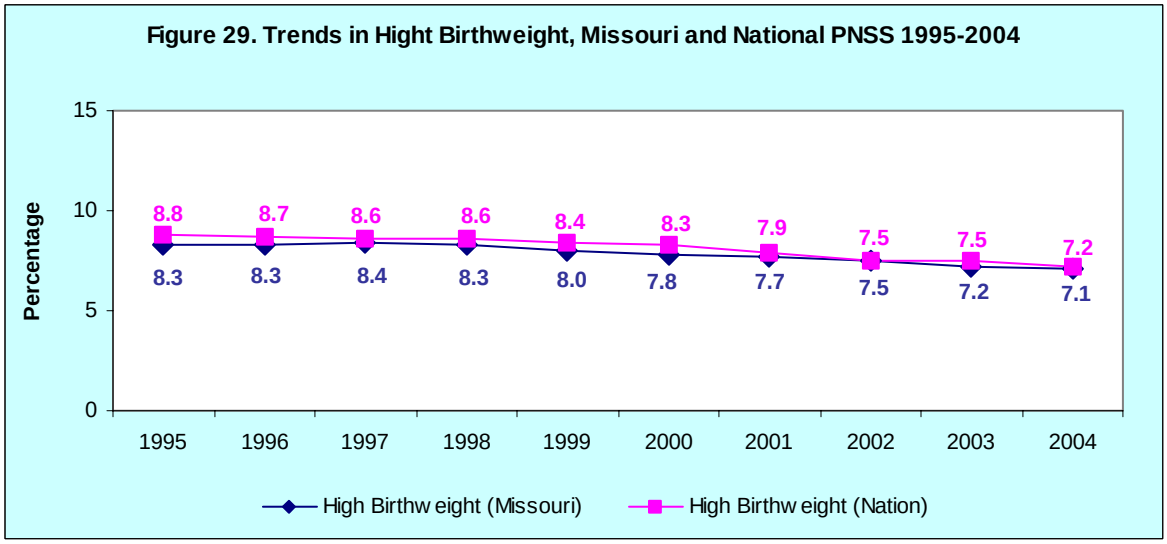
Low birthweight (less than 2,500 grams or 5.5 pounds) is a major determinant of neonatal mortality and post-neonatal mortality [23]. Infants with low birthweight are more likely to experience developmental delays and disabilities than infants with normal birthweight [24]. The most important factors for low birthweight are cigarette smoking [25], followed by nutrition and pre-pregnancy weight. In addition, teenage mothers are at a higher risk for low birthweight [26]. Socioeconomic factors were strongly associated with low birthweight [27]. The Healthy People 2010 Objective is to reduce the prevalence of low birthweight to less than 5%. High birthweight (greater than 4,000 grams) significantly increases the risk of injuries such as shoulder dystocia. Mortality rates are higher among overweight full-term infants compared to infants weighing between 3,000 grams (6.6 pounds) and 4,000 grams (8.8 pounds) [28].

In the 1995-2004 Missouri PNSS, the prevalence of low birthweight has remained stable, while the proportion of infants born overweight has been decreasing slowly from 8.3% in 1995 to 7.1% in 2004 (Figures 28 and 29).

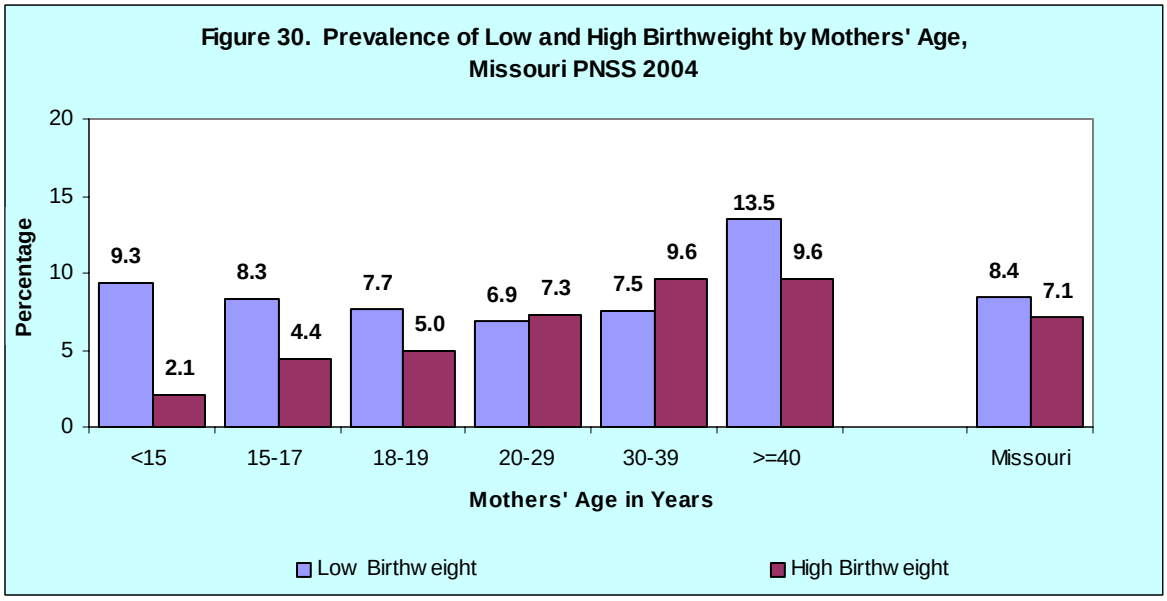
[12] Refer to the maps in Appendix 10 to see prevalence of low birthweight by county, and Appendix 11 for prevalence of high birthweight by county (Missouri PNSS 2002-2004 combined years)



Note: Scale was set up from 0% to 15% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

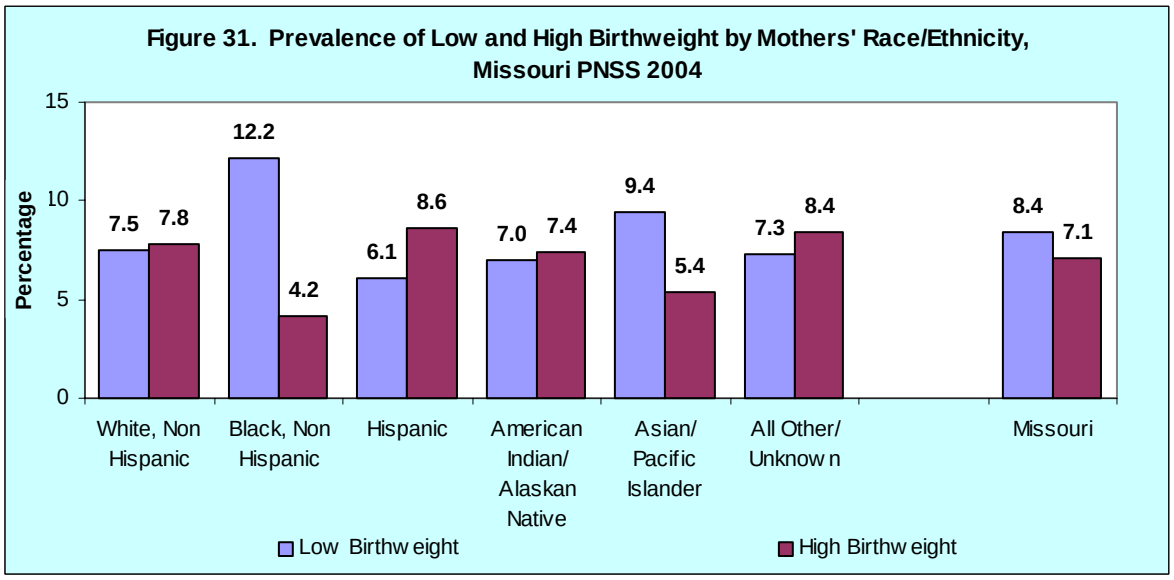


Note: Scale was set up from 0% to 15% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

As described previously, both maternal prepregnancy weight and maternal weight gain (refer back to Figure 9 and Figure 15, respectively) can be considered as strong predictors of low or high birthweight. In the Missouri 2004 PNSS, smoking was also associated with birthweight. The percentage of women who did not smoke during pregnancy and had low birthweight infants was 7.2%, but the percentage of women who smoked and had low birthweight infants was 10.2%. Figure 30 shows that the risk of having a low birthweight infant was high among women less than 15 years old (9.3%) and even higher among women age 40 years and older (13.5%). In the Missouri 2004 PNSS, the highest risk of delivering a high birthweight infant (9.6%) was among women age 30-39 years, as well as 40 years and older, than in all other age groups.



Note: Scale was set up from 0% to 15% to show the prevalence in more detail.

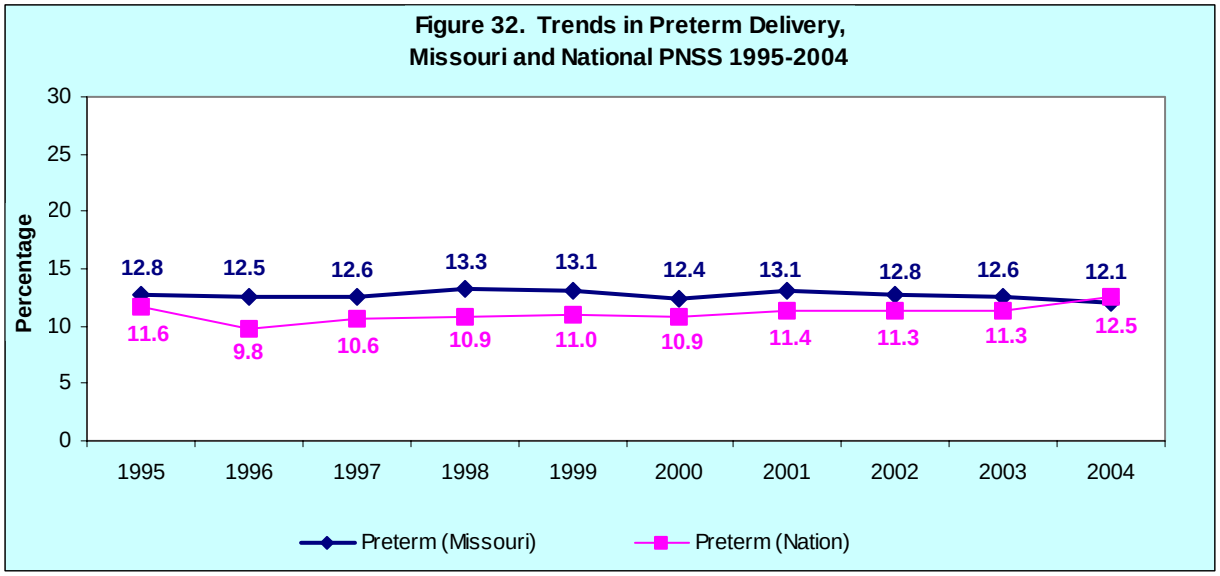
In the Missouri 2004 PNSS, Black, Non Hispanic and Asian/Pacific Islander women had a higher rate of delivering a low birthweight infant (12.2% and 9.4 %, respectively) than all the

other races (Figure 31). In fact, Black, Non Hispanic women were two times more likely to have low birthweight babies than Hispanic women and 1.6 times more likely than White, Non Hispanic women. In 2004, the proportion of infants born with low birthweight remained higher than the Healthy People 2010 Objective of 5%. However, the prevalence of low birthweight in Hispanic women was very close to the target (6.1%), although they also had the highest rate of delivering a high birthweight infant (8.6%).

Preterm Delivery[13]

Preterm birth refers to delivery before 37 weeks of gestation. Preterm birth has been identified as one of the most important perinatal health problems in industrialized nations [29]. An infant born prematurely is at an increased risk of neurological and respiratory disorders, ocular diseases, and death [30]. It is increasingly recognized that the prevention of preterm birth is crucial to improving pregnancy outcomes [31]. According to the Institute of Medicine, preventing problems such as iron deficiency anemia and inappropriate gestational weight gain through nutrition intervention could minimize preterm births. The Healthy People 2010 Objective is to reduce preterm delivery to not more than 7.6%.

The prevalence of preterm deliveries among PNSS participants remained fairly stable from 1995 to 2004, but has been declining since 2001 (Figure 32). It was 12.1% in 2004.

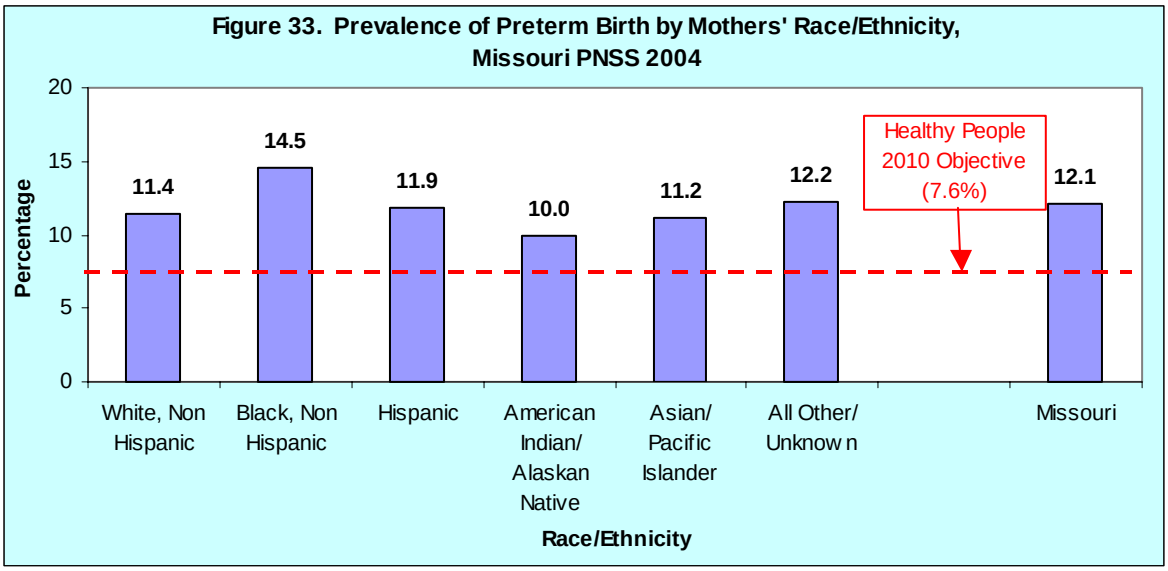


Note: Scale was set up from 0% to 30% to show the prevalence in more detail. It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

In 2004, the prevalence of preterm deliveries was highest (13.8%) among women who were underweight before pregnancy (refer back to Figure 10). Preterm birth was also associated with less than ideal gestational weight gain (refer back to Figure 15). Additionally, the prevalence of preterm deliveries varied in different racial and ethnic groups (Figure 33). In 2004, the highest rate (14.5%) was for Black, Non Hispanic mothers, and the lowest rate (10.0%) was for American Indian/Alaskan Native mothers[13].

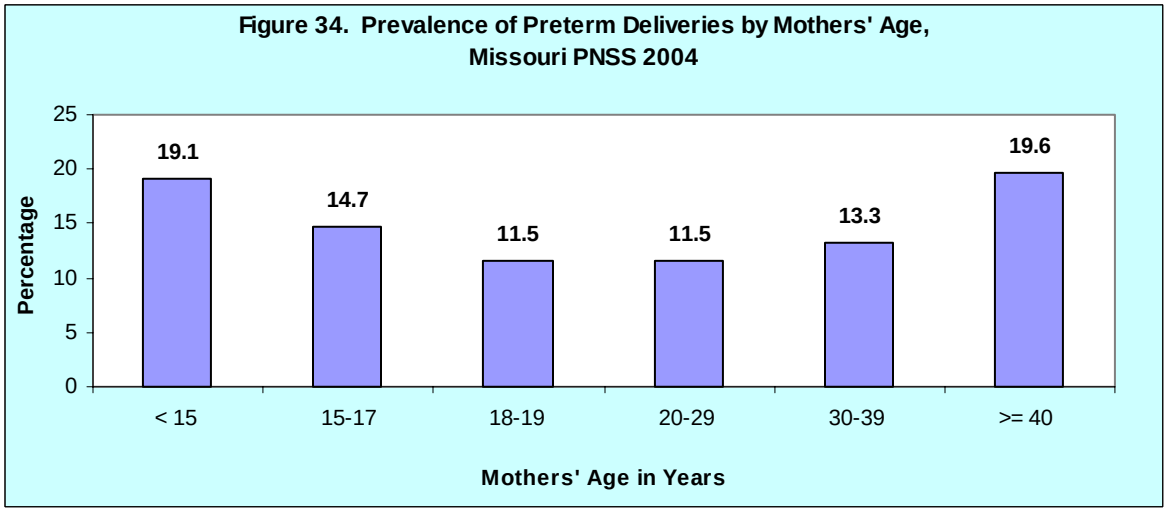
[13] Refer to the map in Appendix 12 to see prevalence of preterm delivery by county (Missouri PNSS 2002-2004 combined years)

[13] There were only 259 American Indian/Alaskan Native mothers for this indicator.



Note: Scale was set up from 0% to 20% to show the prevalence in more detail.

In Figure 34, the highest proportions of preterm babies were born to mothers age 40 years and older (19.6%) and less than 15 years old (19.1%). However, since the number of women in these two age groups were small (n = 363 for mothers 40 years and older and n = 194 for mothers less than 15 years), age may not be a sufficient reason for the relatively higher percentages of preterm birth. The lowest percentage of preterm babies (11.5%) was among mothers in the 18-19 years and 20-29 years age groups.

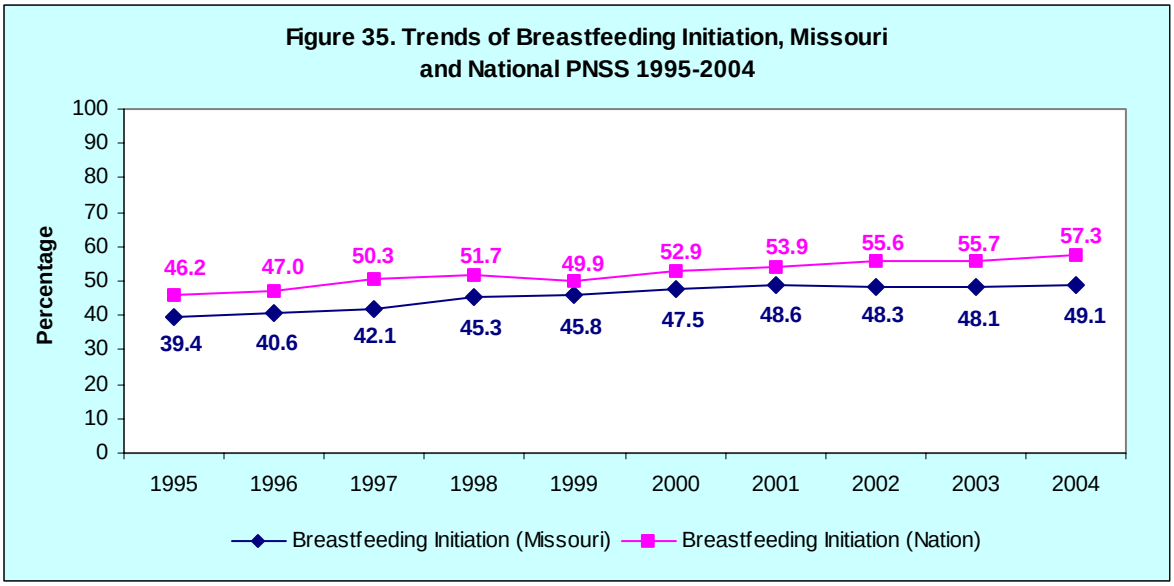


Note: Scale was set up from 0% to 25% to show the prevalence in more detail.

Breastfeeding Initiation

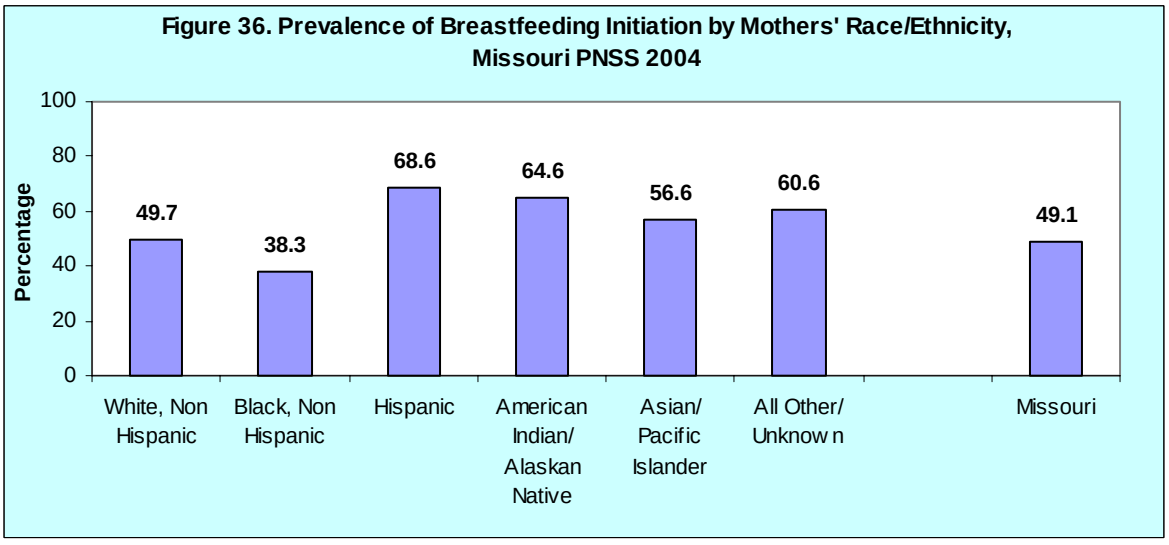
Advantages for infants, mothers, families, and society from breastfeeding have been documented by many studies [32,38,39]. These advantages include health, nutritional, immunologic, developmental, psychological, social, economic, and environmental benefits [33,38,39,40]. The benefits for mothers include earlier return to prepregnancy weight [34,37], decreased risk of breast cancer [35,37,38], and decreased risk of ovarian cancer [36,37,38].

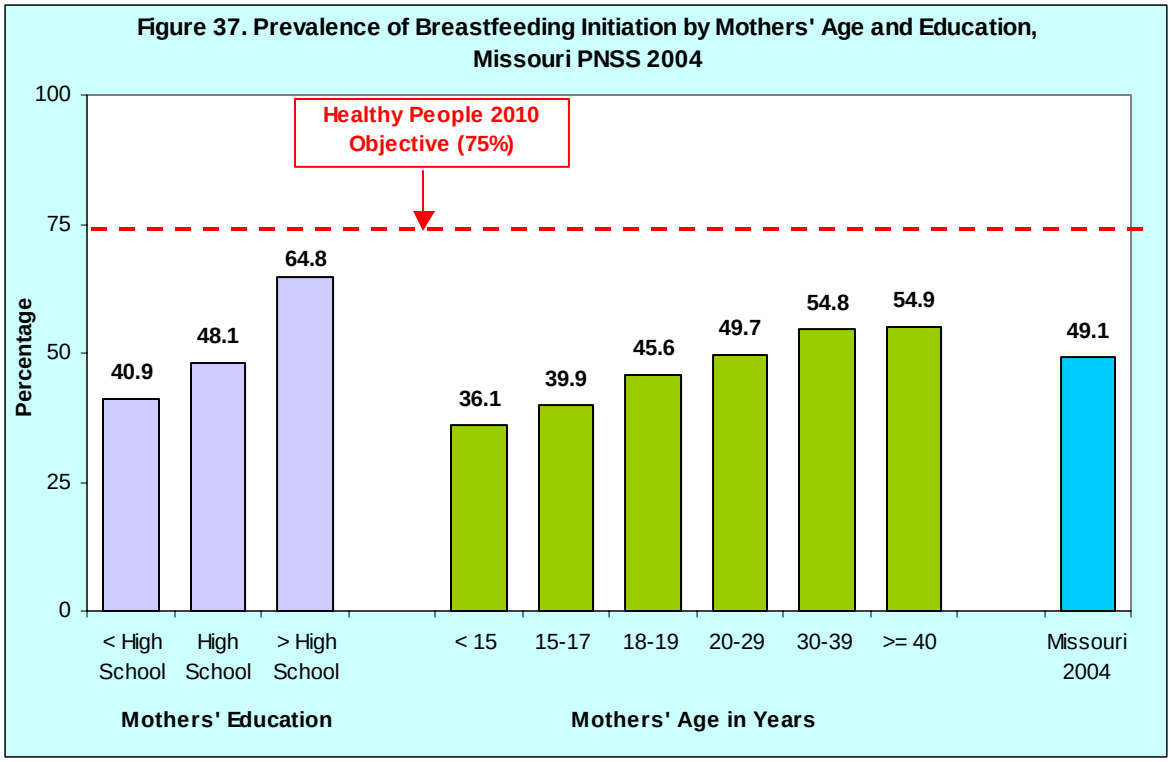
Breastfeeding is also associated with a lower incidence of obesity during childhood and adolescence, insulin-dependent diabetes mellitus, hypertension and hypercholesterolemia in adulthood [37,38]. The Healthy People 2010 Objective for breastfeeding initiation is to increase the breastfeeding initiation rate to at least 75%.



Note: It is advised that the trends data in Missouri and the nation should not be compared directly since they had different distributions on race/ethnicity.

From 1995 to 2004, the proportion of Missouri PNSS women who initiated breastfeeding increased from 39.4% to 49.1% (Figure 35). In the 2004 Missouri PNSS, the percentage of women who initiated breastfeeding was less than the Healthy People 2010 Objective of 75%. The percentage of ever breastfed varied by mothers' race/ethnicity. Only 38.3% of Black, Non Hispanic mothers initiated breastfeeding, while 68.6% of Hispanic mothers initiated breastfeeding in the Missouri 2004 PNSS (Figure 36).





In Figure 37, the prevalence of breastfeeding initiation by mothers increased with age and educational level. In the Missouri 2004 PNSS, participants 40 years of age or older were 1.5 times more likely to report breastfeeding initiation, compared to women younger than 15 years. With regard to education, the highest percentage of mothers who initiated breastfeeding (64.8%) was among women with greater than high school education and the lowest percentage was among women with less than high school education (40.9%).

CONCLUSIONS AND RECOMMENDATIONS

An important use of the PNSS data is monitoring the Healthy People 2010 Objectives. These objectives were designed to serve as goals for monitoring progress toward improving the health of the nation. Missouri's PNSS population is moving toward the goals on prenatal care, preterm birth, and breastfeeding initiation, but in the opposite direction to the goal of gaining recommended weight. There has been an overall slight increase in the percentage of pregnant women who received medical care in the first trimester since 1999, and an overall slight decrease in the rate of preterm delivery since 1998. There has been a significant increase in the percentage of mothers who initiated breastfeeding in the early postpartum period since 1995. However, the percentage of women who had greater than ideal weight gain has been increasing since 1997. The 10-year trend data (from 1995-2004) showed that the prevalence of anemia among women in their 3rd trimester of pregnancy and the prevalence of having low birth weight among infants remained relatively stable overall.

Compared with the National PNSS data[14] as shown in Table 1, the percentage of pregnant women in Missouri PNSS who had ideal weight gain was higher than the average national level, and the percentage of women who had preterm births was lower than the average national level. However, the percentage of pregnant women who had anemia in the third trimester and the percentage of women who had low birthweight babies were higher than the national average levels. The percentage of women who received prenatal care in the first trimester and the percentage of women who had breastfeeding initiation were lower than the national average levels.

Table 1. Monitoring Healthy People 2010 Objectives Using Missouri PNSS Trends 1995-2004 and Comparing Missouri and National PNSS Data in 2004 on Selected Health and Behavioral Indicators

Indicator	Healthy People 2010 Objectives Monitored by PNSS*	Trend of the Missouri PNSS Data 1995-2004	National PNSS Data 2004	Missouri PNSS Data 2004**
Ideal Weight Gain	Increase the proportion of women who achieve a recommended weight gain during their pregnancies (no target established)	Decrease	30.7	34.6
Anemia in 3rd Trimester	Decrease in the proportion of low-income pregnant women with anemia in their third trimester to **20%** (19-13)	Relatively stable	30.7	35.5
Prenatal Care 1st Trimester	Increase the proportion of pregnant women who receive prenatal care in the first trimester to **90%** (16-10a)	Overall slight increase since 1999	76.7	72.9
Low Birthweight	Decrease low birthweight to **5 %** (16-10b)	Relatively stable	8.2	8.3
Preterm Birth	Decrease preterm births to **7.6%** (16-11)	Overall slight decrease since 1998	12.5	12.2
Breastfeeding Initiation	Increase the proportion of mothers who breast feed in the early postpartum period to **75%** (16-19a)	Increase	57.3	51.9

*Healthy People 2010 Objectives on web: http://www.healthypeople.gov.
**Adjusted rates according to CDC's procedure.

The 2004 Missouri PNSS data indicate that state and community public health programs are needed to support the following interventions to meet the state health goals for maternal and child nutrition in low-income populations:

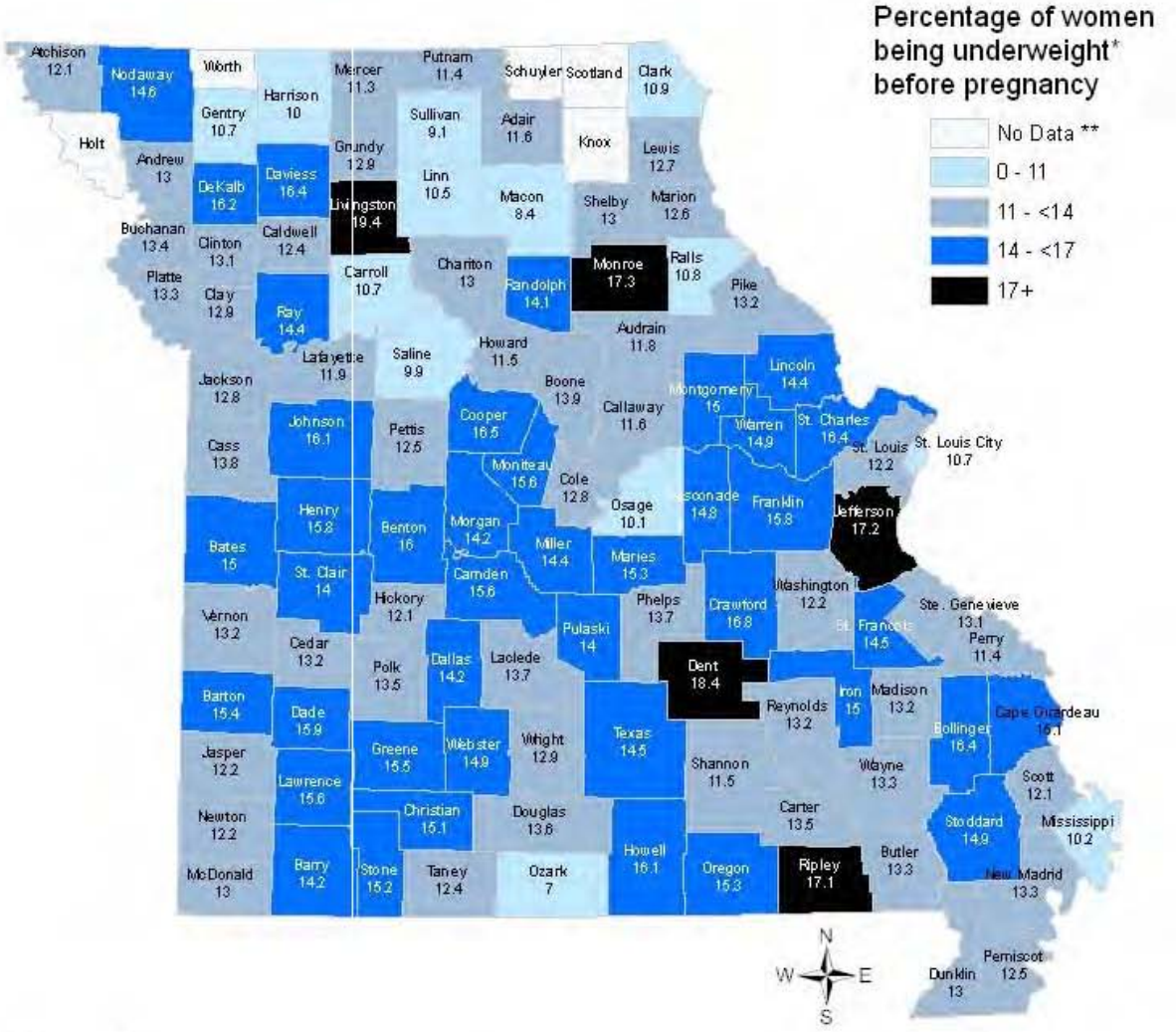
- Women who are underweight before pregnancy should be encouraged to gain some weight to reach normal prepregnancy weight to prevent complications, such as low birthweight and preterm delivery. In contrast, women who are overweight or obese before pregnancy could be counseled on how to manage weight to prevent the related negative birth outcomes, such as high birthweight.
- Support nutrition education focused on iron rich foods and iron absorption-enhancing foods to help reduce the percentage of women with low hemoglobin/hematocrit participating in PNSS. Also, promote adequate multivitamin and iron supplement intake during pregnancy to decrease the risk of having iron deficiency anemia.

[14] The proportions of racial and ethnic indicators in the national 2004 PNSS were different from those in the Missouri 2004 PNSS. Therefore, to make the Missouri PNSS population comparable on indicators of interest to the Nation, a standardization procedure was applied to Missouri's PNSS data when a comparison occurs. The procedure is available on CDC's website: http://www.cdc.gov/pednss/how_to/interpret_data/what/example.htm.

- Increase efforts in promoting early identification of pregnancy and early entry into comprehensive prenatal care, including medical care and WIC program services to better help pregnant women obtain all the important information and counseling needed, such as the harm of smoking and the benefit of appropriate food intake.
- Continue establishment of breastfeeding as a social norm. Programs combining breastfeeding education with behaviorally-oriented counseling were associated with increased rates of breastfeeding initiation and its continuation for up to 3 months [37].

Appendix 1

Prevalence of Prepregnancy Underweight* by County (Missouri PNSS 2002 - 2004 Combined Years)



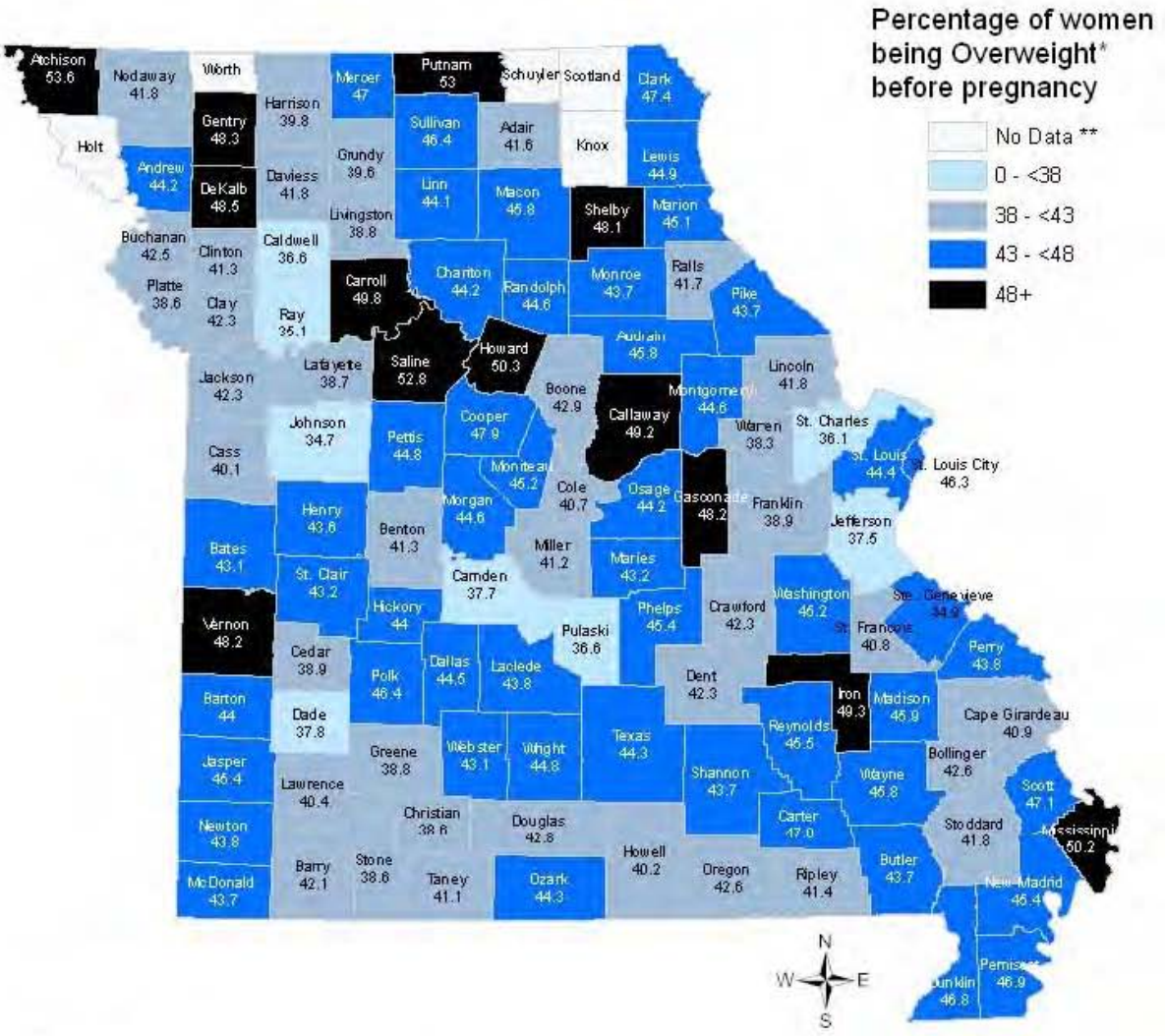
* BMI < 19.8

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 2

Prevalence of Prepregnancy Overweight* by County (Missouri PNSS 2002 - 2004 Combined Years)

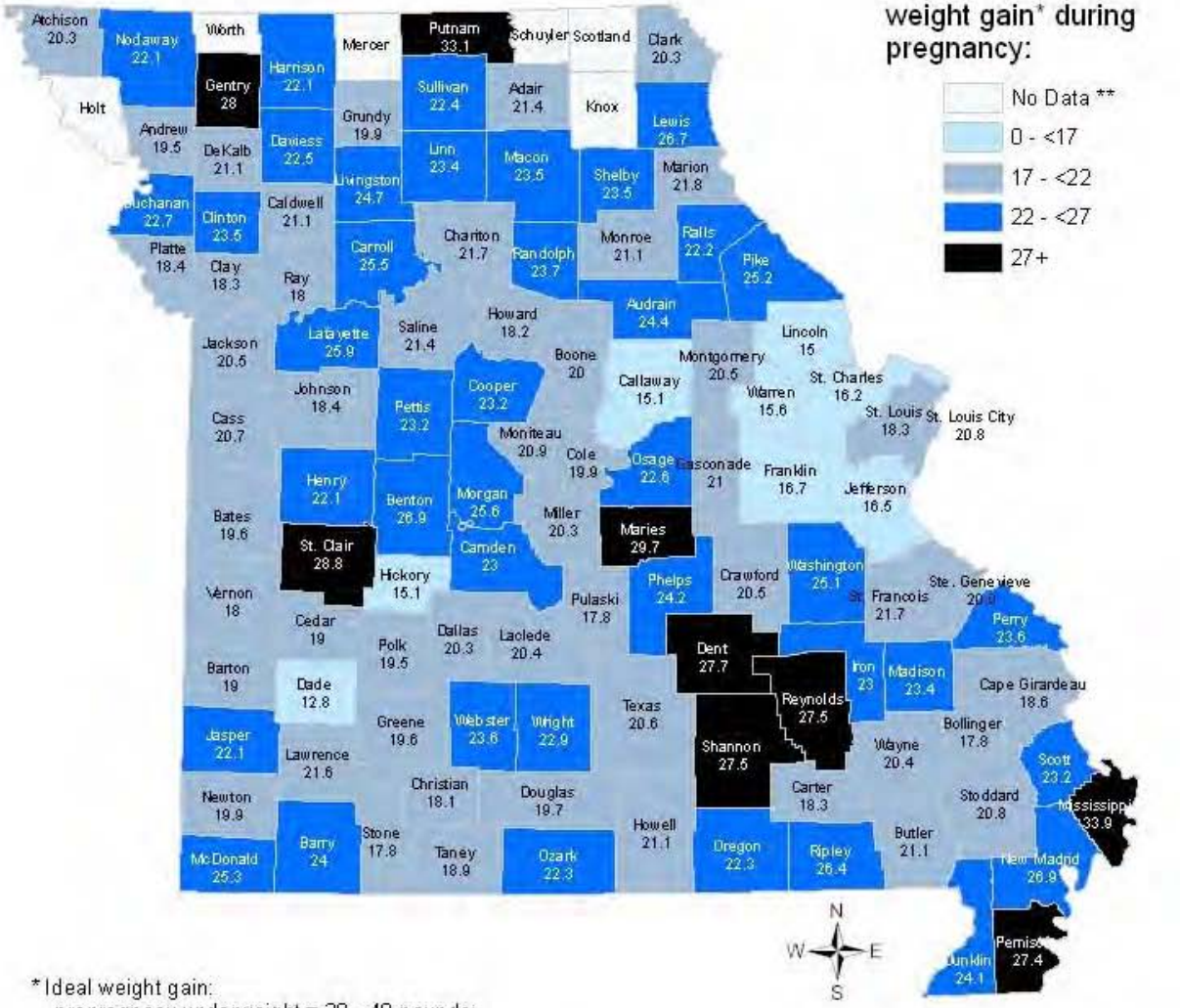


* BMI >= 26.5

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Prevalence of Less than Ideal Maternal Weight Gain* by County (Missouri PNSS 2002 - 2004 Combined Years)



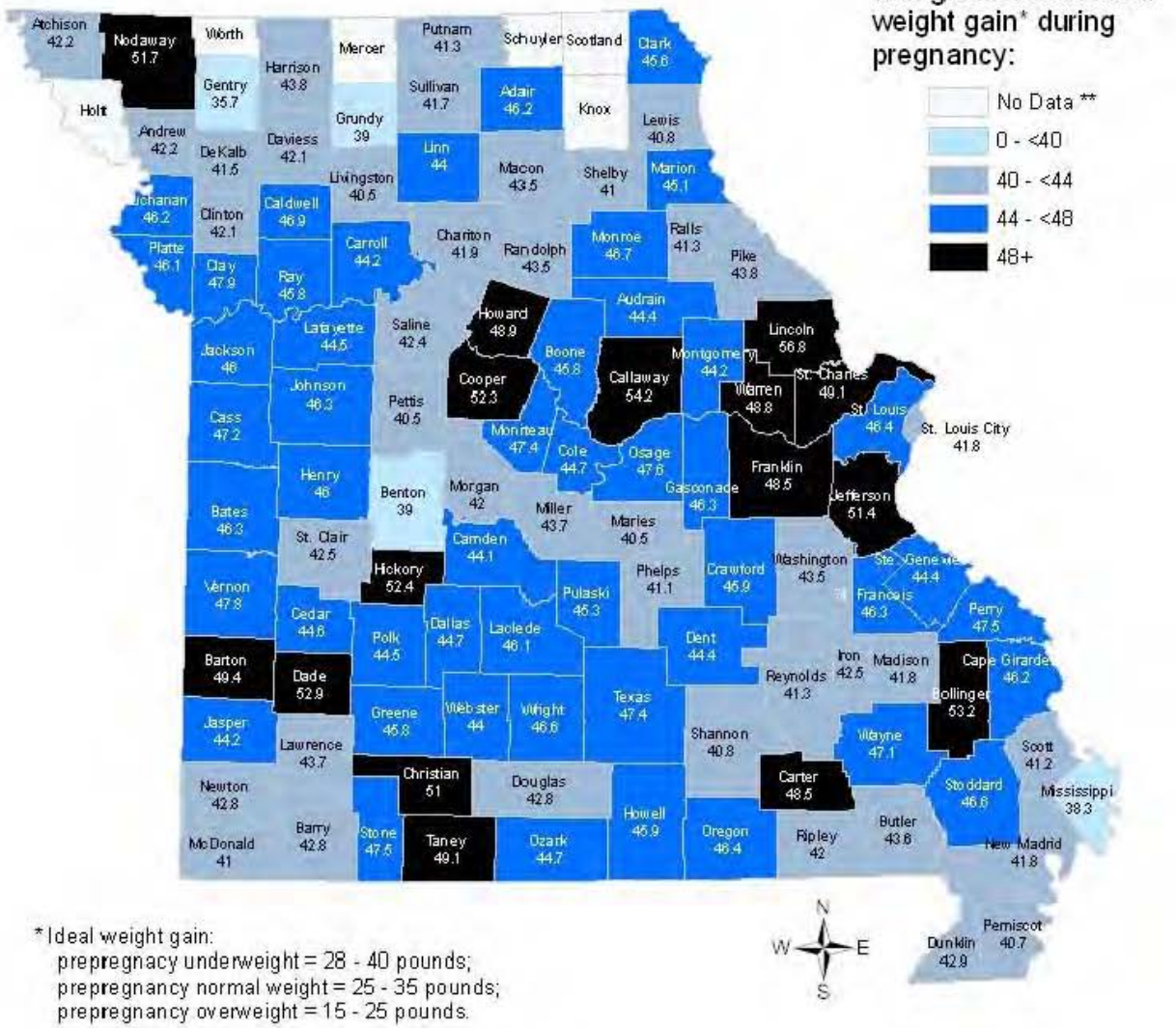
* Ideal weight gain:
prepregnacy underweight = 28 - 40 pounds;
prepregnancy normal weight = 25 - 35 pounds;
prepregnancy overweight = 15 - 25 pounds.

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 4

Prevalence of Greater than Ideal Maternal Weight Gain* by County (Missouri PNSS 2002 - 2004 Combined Years)



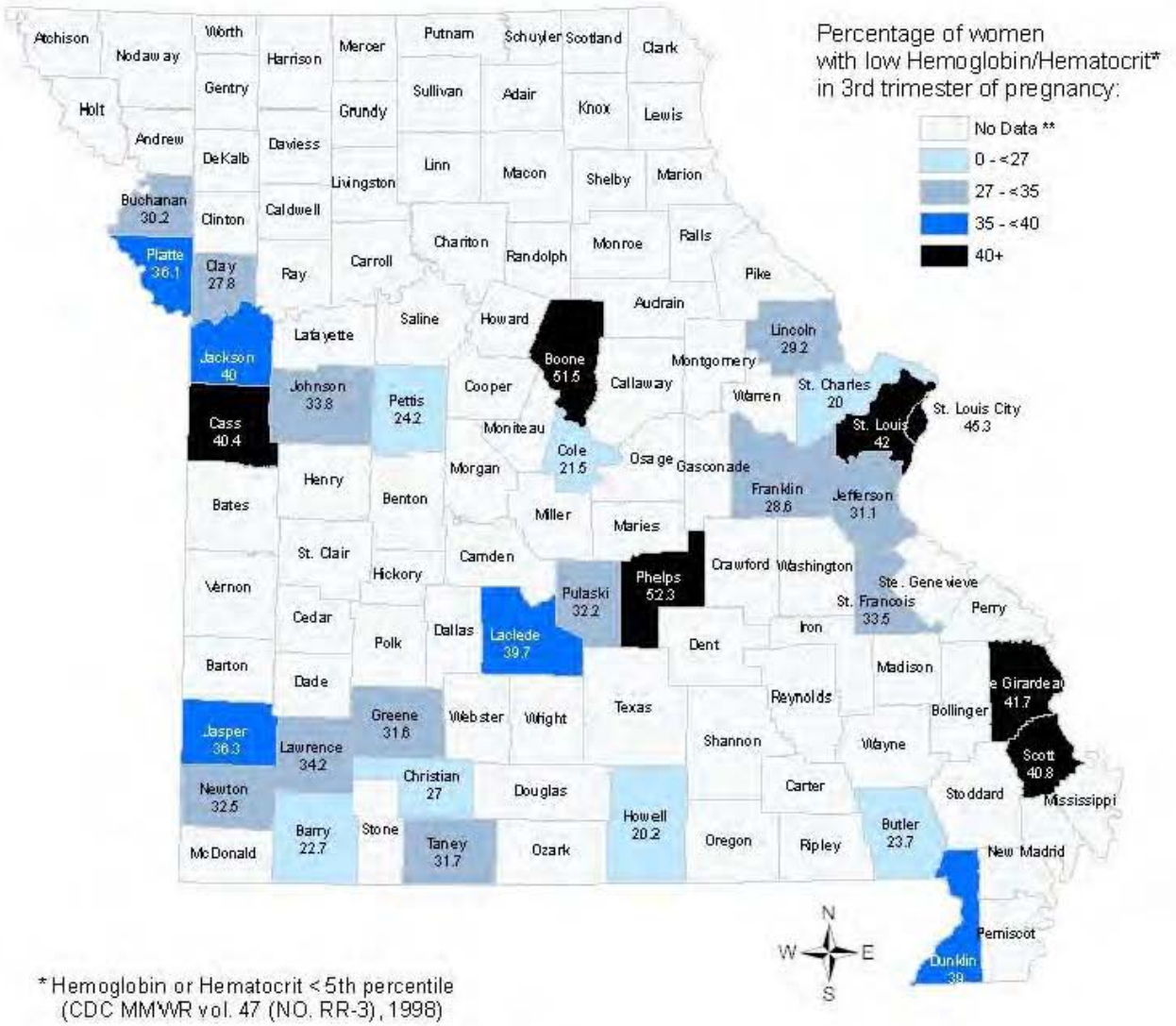
* Ideal weight gain:
prepregnacy underweight = 28 - 40 pounds;
prepregnancy normal weight = 25 - 35 pounds;
prepregnancy overweight = 15 - 25 pounds.

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 5

Prevalence of Low Hemoglobin/Hematocit* in 3rd Trimester of Pregnancy, by County (Missouri PNSS 2002 - 2004 Combined Years)



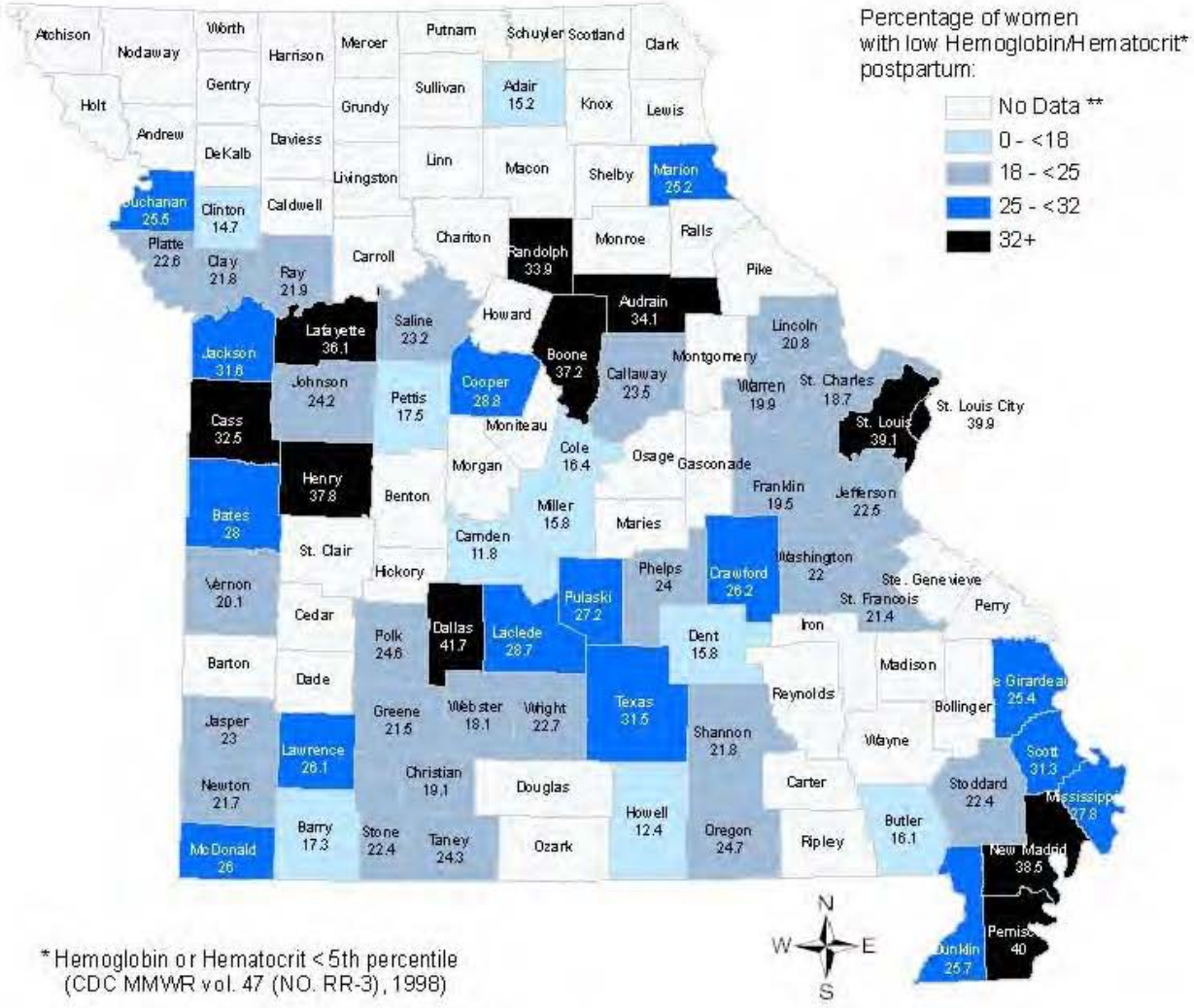
* Hemoglobin or Hematocrit < 5th percentile (CDC MMWR vol. 47 (NO. RR-3), 1998)

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 6

Prevalence of Low Hemoglobin/Hematocit* Postpartum, by County (Missouri PNSS 2002 - 2004 Combined Years)



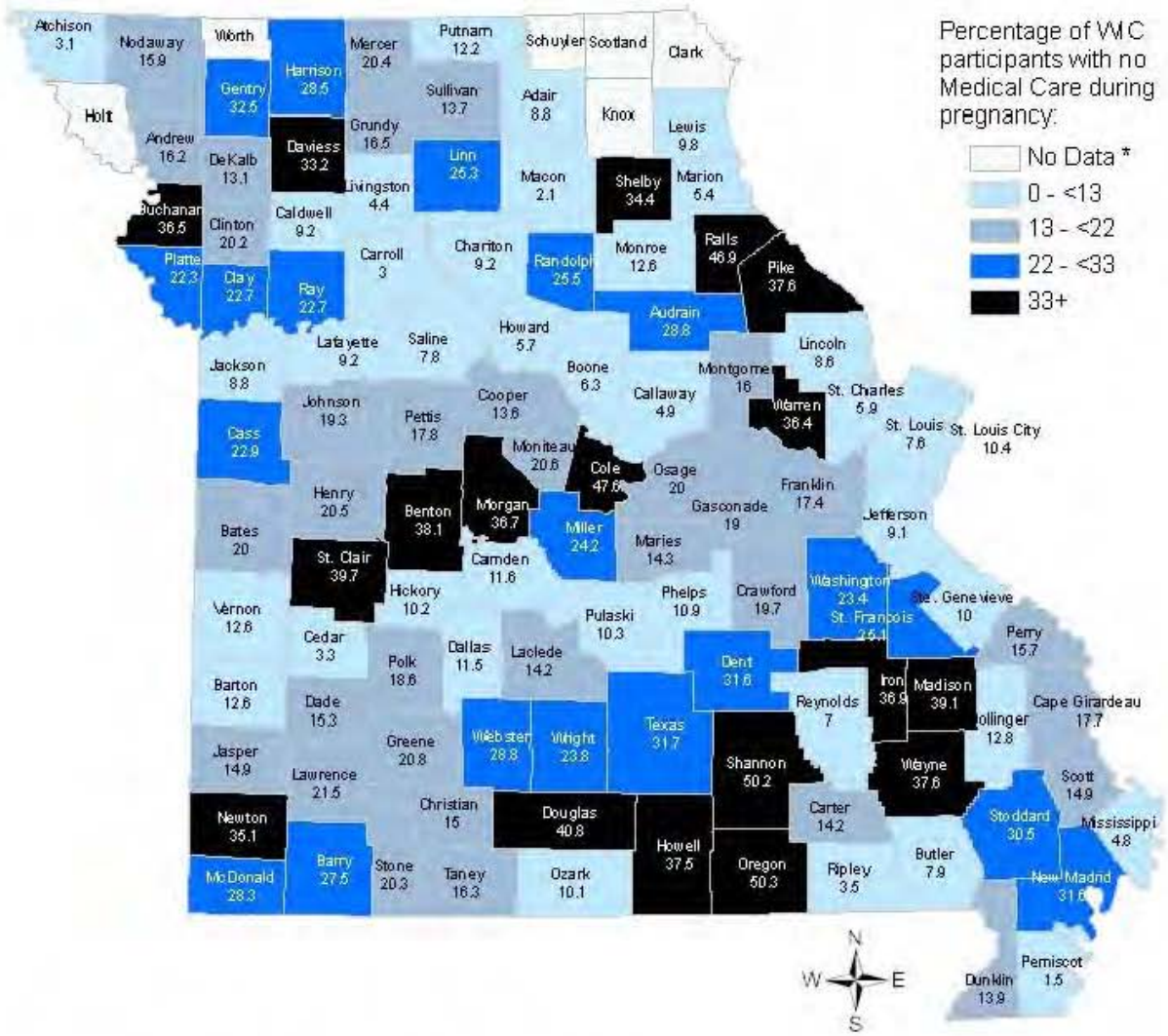
* Hemoglobin or Hematocrit < 5th percentile (CDC MMWR vol. 47 (NO. RR-3), 1998)

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 7

Percentage of WIC Participants with No Medical Care During the Pregnancy, by County (Missouri PNSS 2002 - 2004 Combined Years)

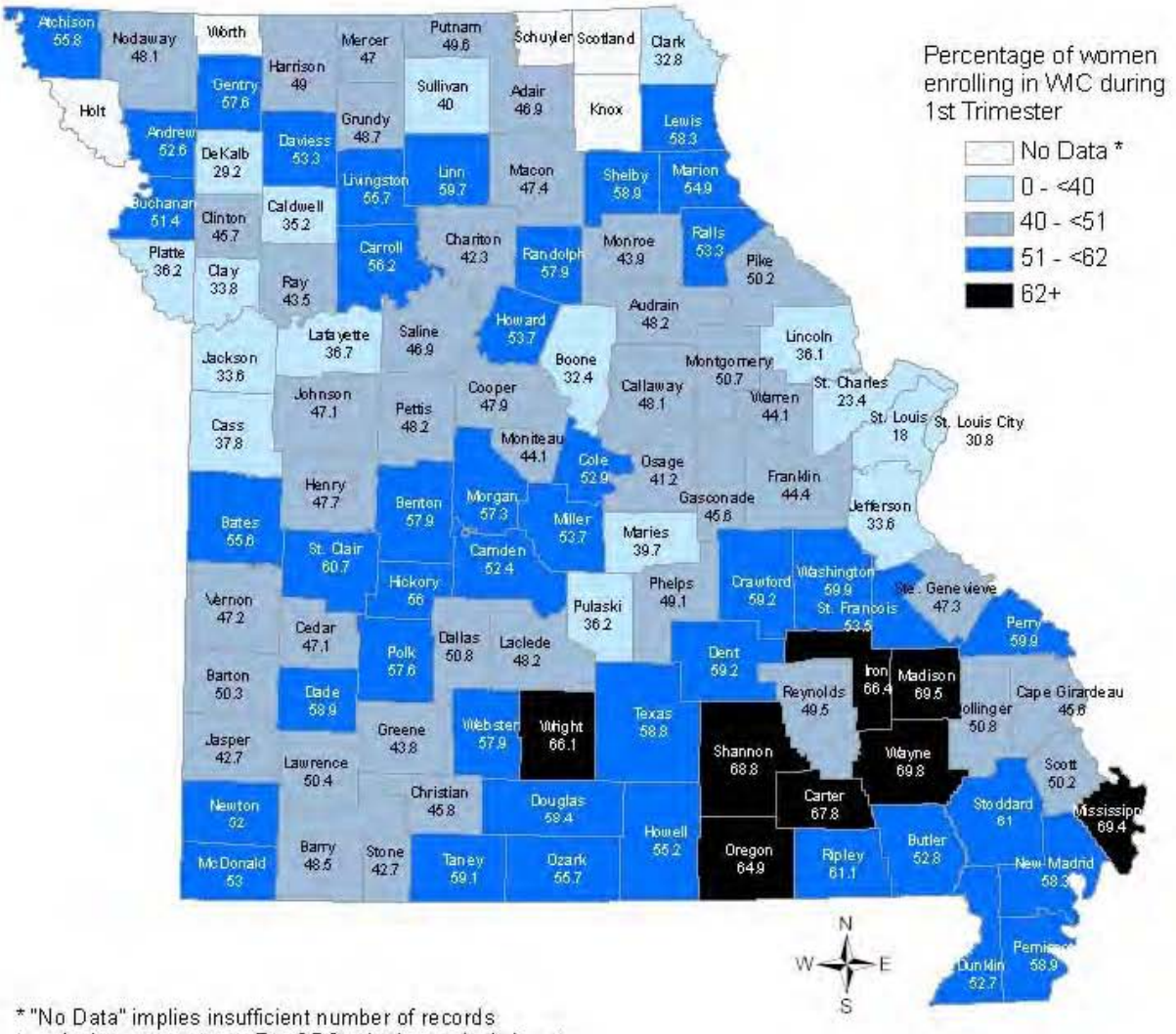


* "No Data" implies insufficient number of records to calculate percentage. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 8

Percentage of Women Enrolling in WIC During 1st Trimester of Pregnancy, by County (Missouri PNSS 2002 - 2004 Combined Years)

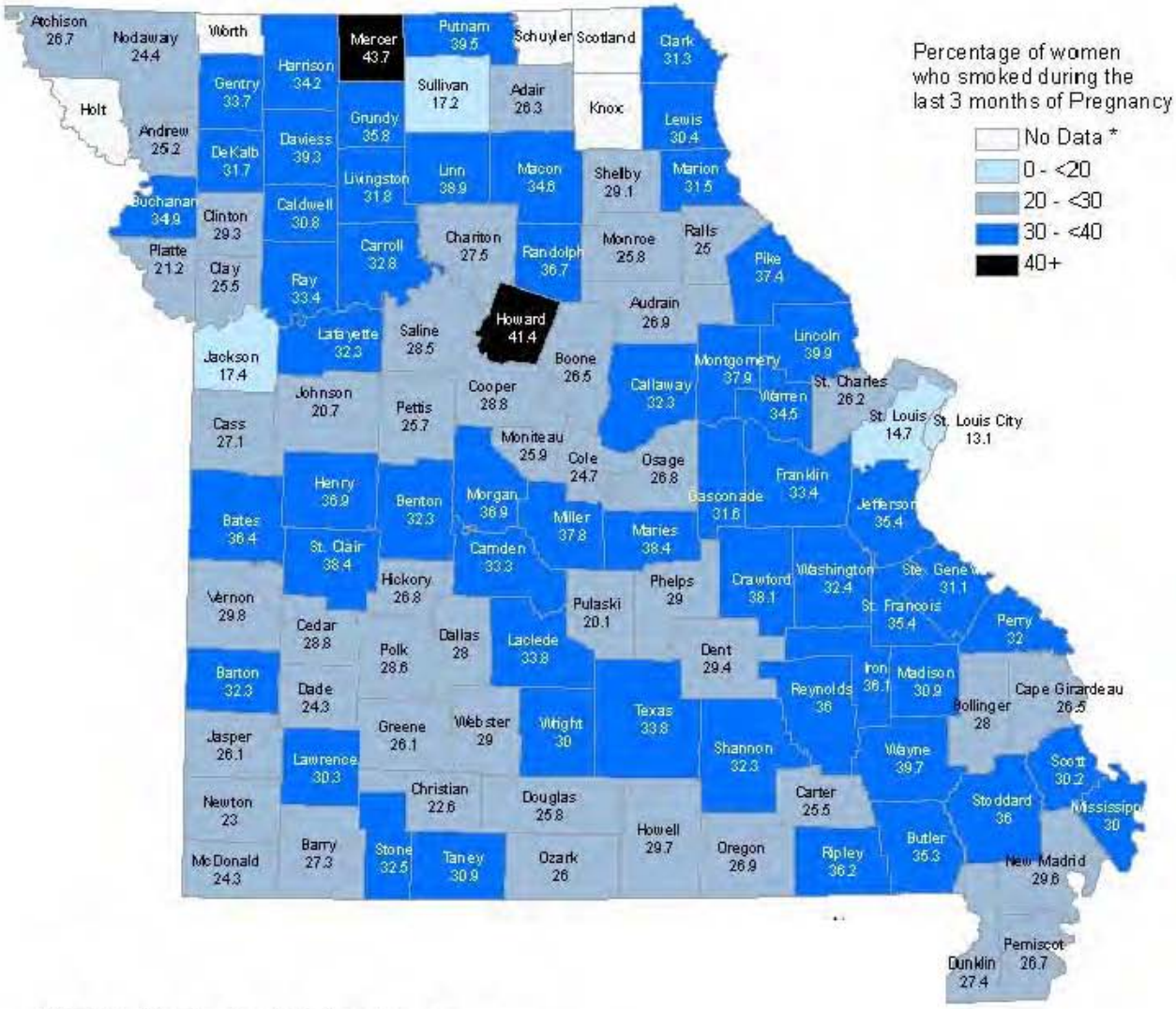


* "No Data" implies insufficient number of records to calculate percentage. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 9

Percentage of Women Who Smoked During Last 3 Months of Pregnancy by County (Missouri PNSS 2002 - 2004 Combined Years)

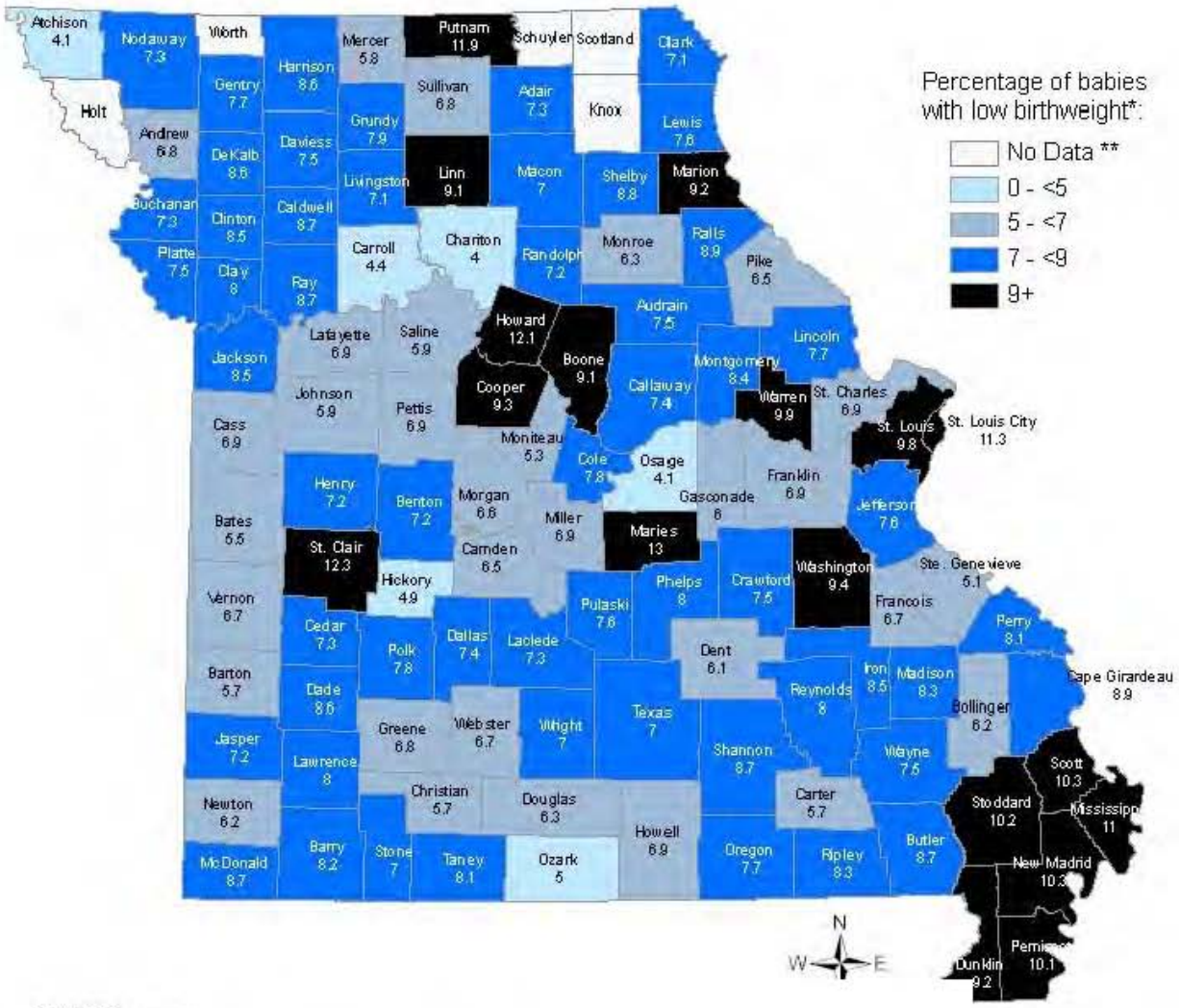


* "No Data" implies insufficient number o s to calculate percentage. Per CDC criteria is is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 10

Prevalence of Low Birthweight*, by County (Missouri PNSS 2002 - 2004 Combined Years)

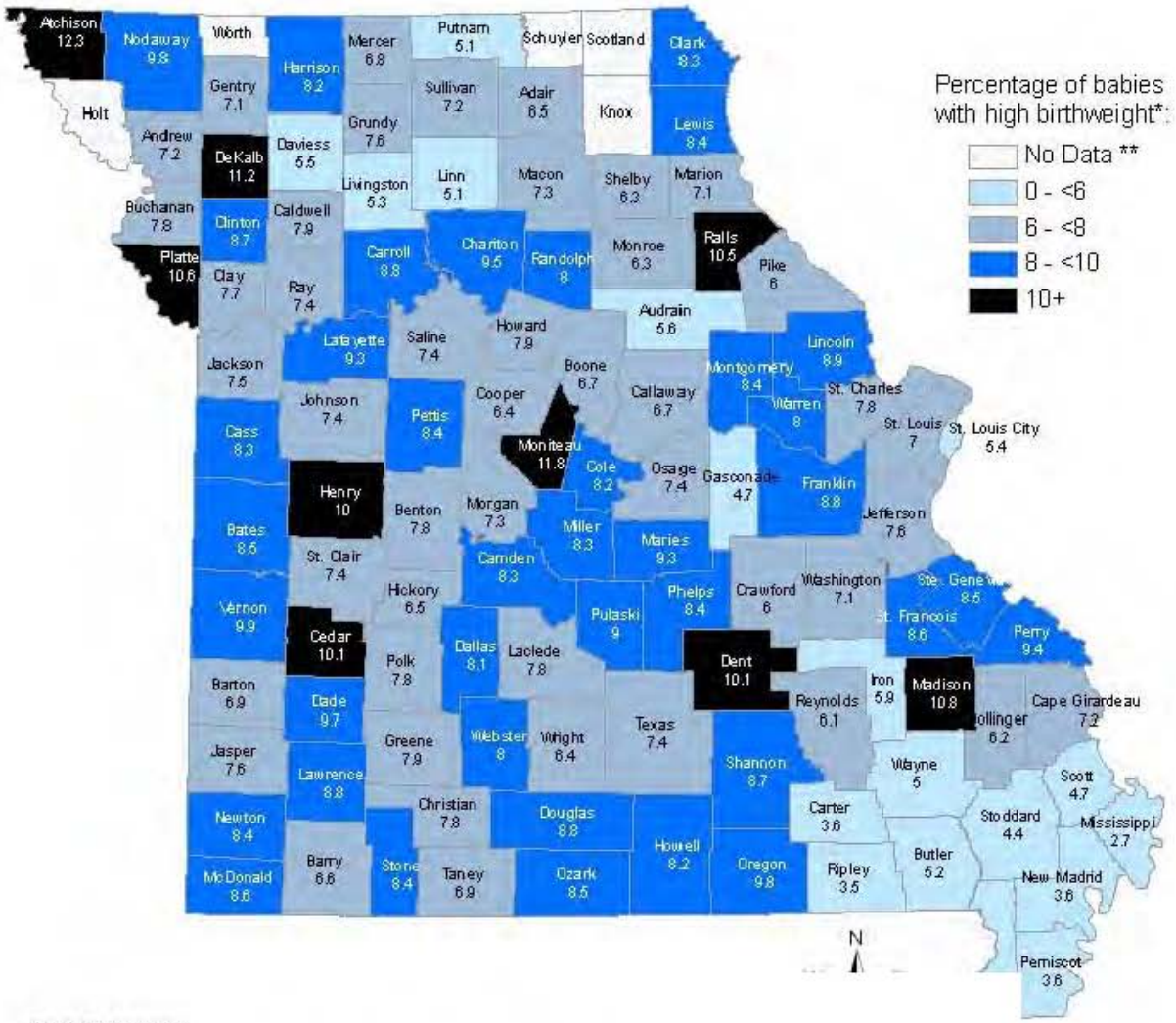


* < 2,500 grams

** "No Data" implies insufficient number to calculate prevalence. Per CDC criteri conducted if number of records is less th y.

Sourc. . . . . gnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Prevalence of High Birthweight*, by County (Missouri PNSS 2002 - 2004 Combined Years)



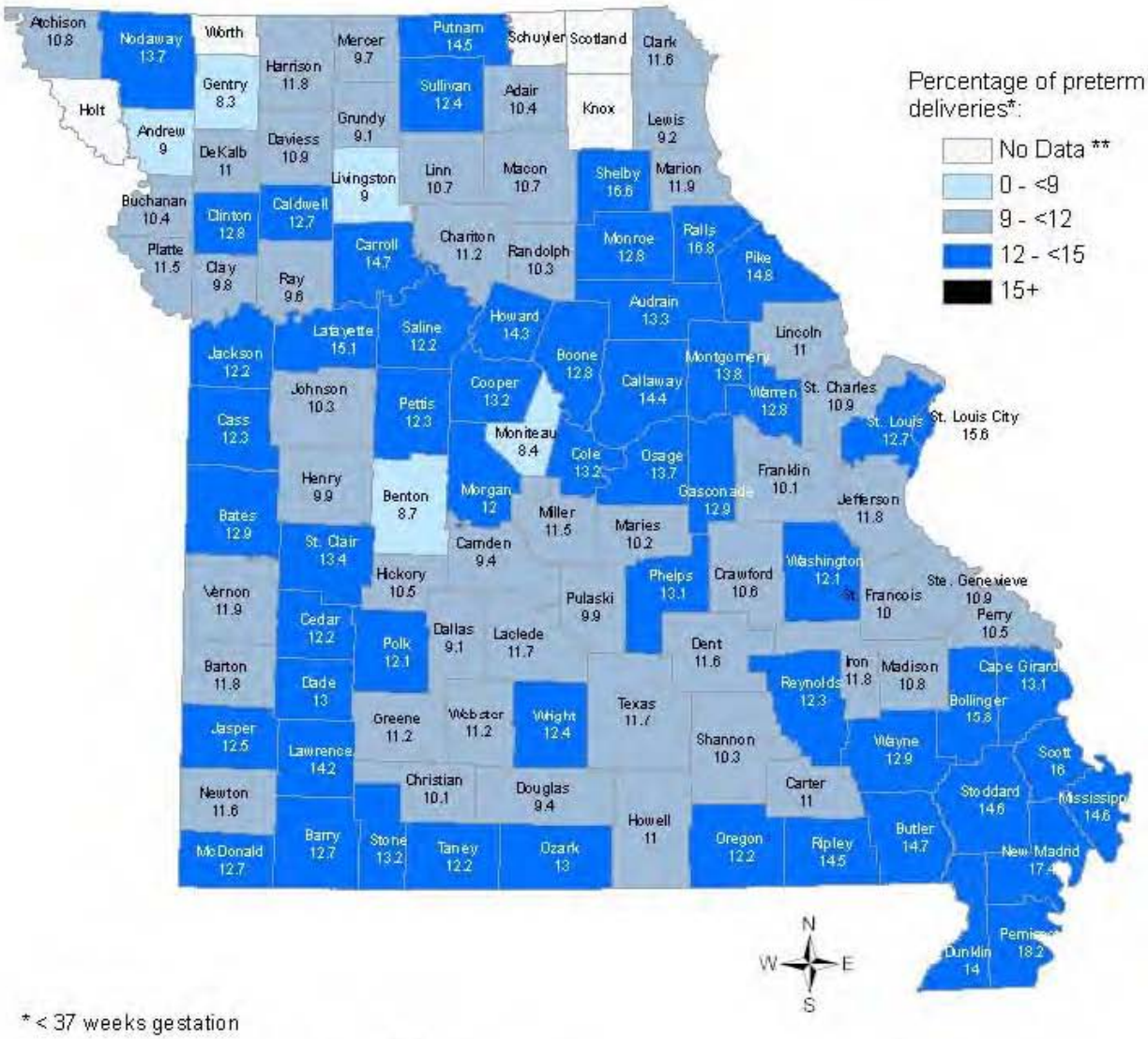
* > 4,000 grams

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

Appendix 12

Prevalence of Preterm Delivery*, by County (Missouri PNSS 2002 - 2004 Combined Years)



* < 37 weeks gestation

** "No Data" implies insufficient number of records to calculate prevalence. Per CDC criteria, analysis is not conducted if number of records is less than 100 per county.

Source: Missouri Pregnancy Nutrition Surveillance System
2002-2004 Combined Years
Missouri Department of Health and Senior Services

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